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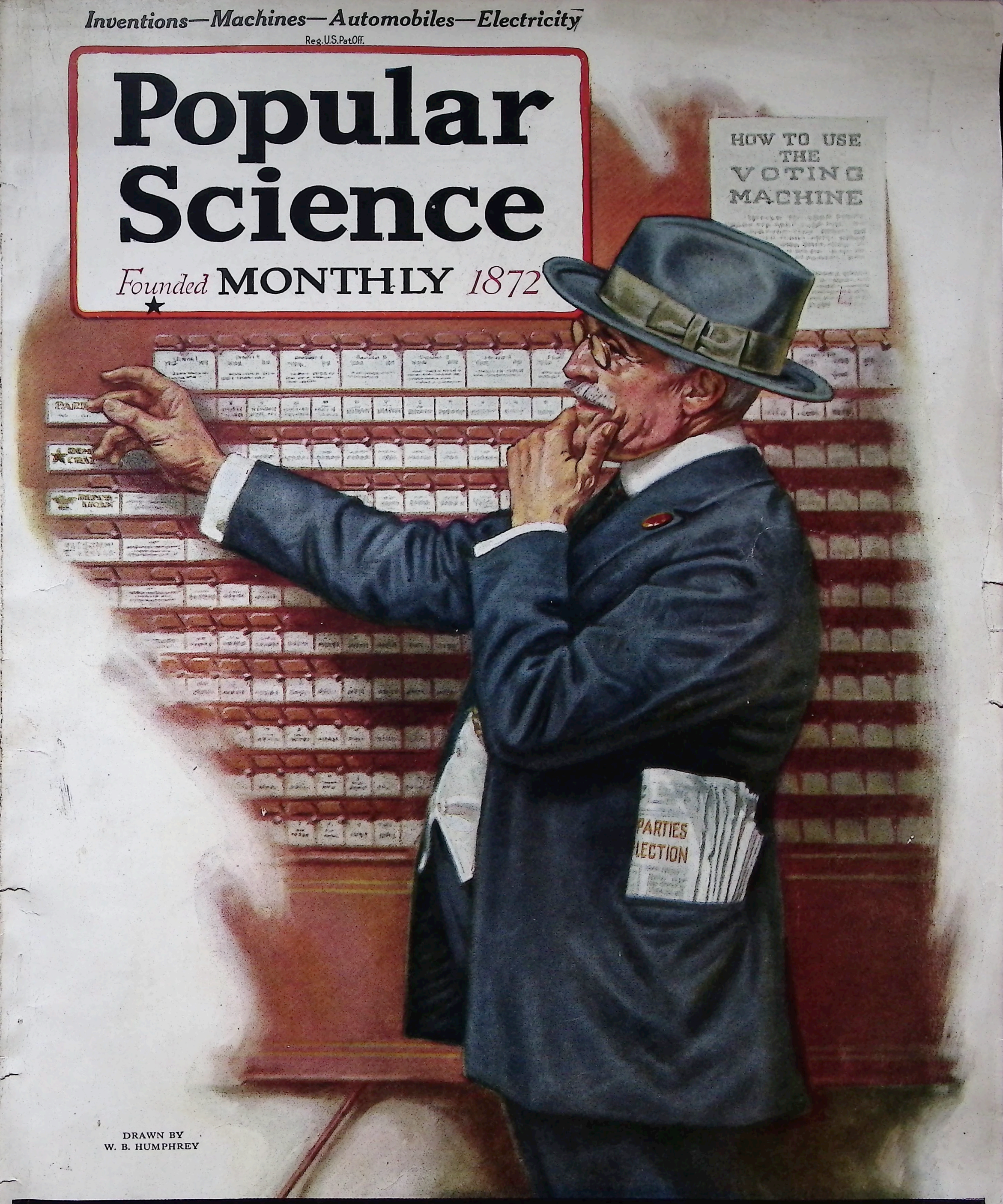

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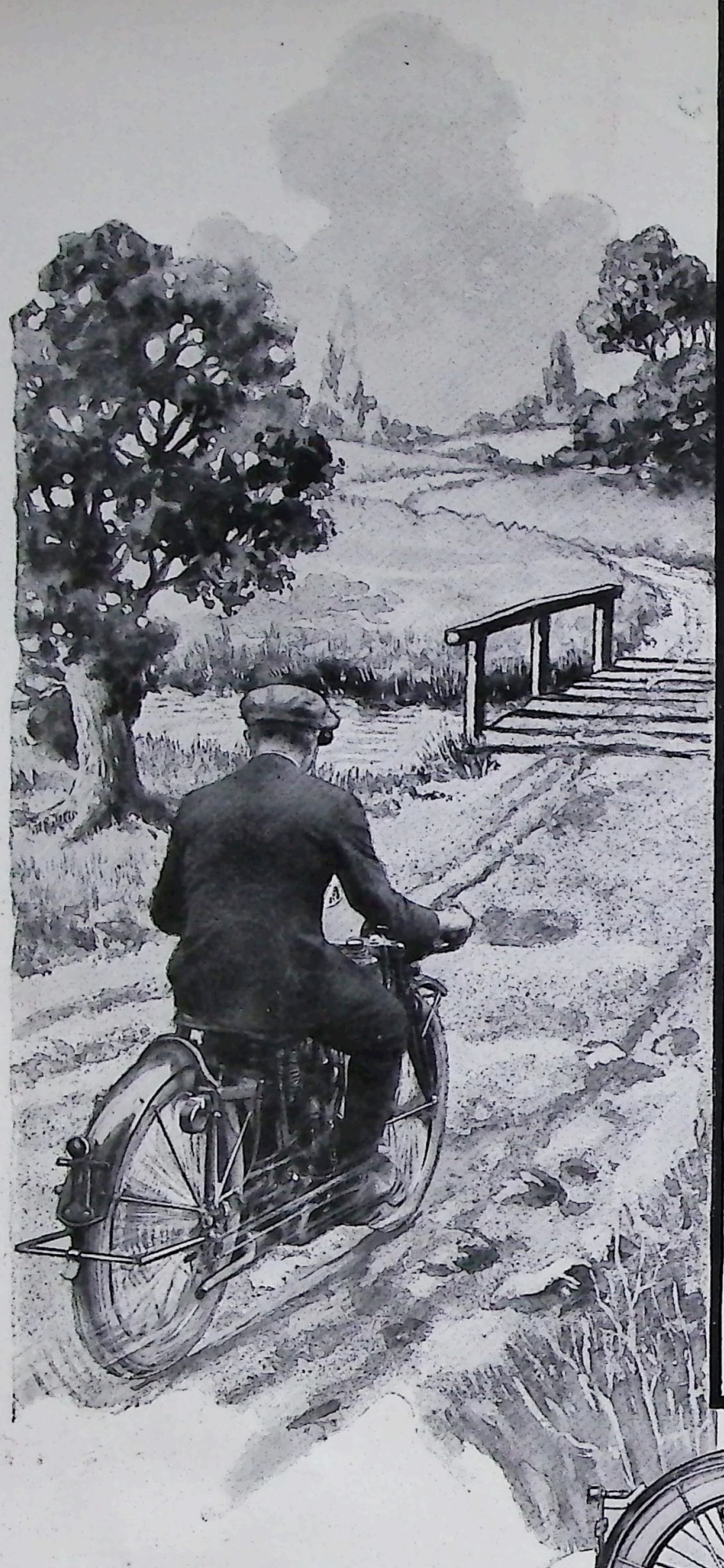

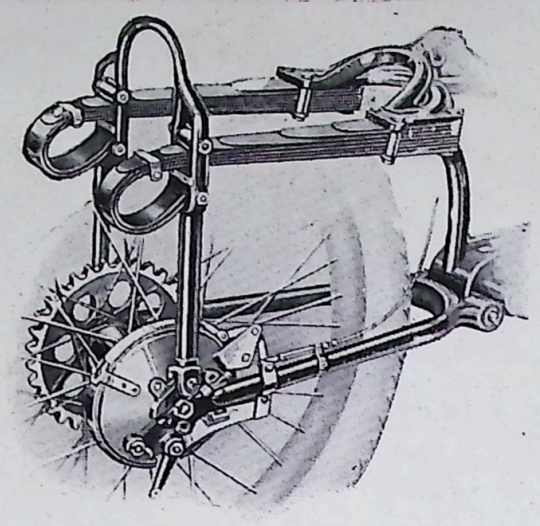

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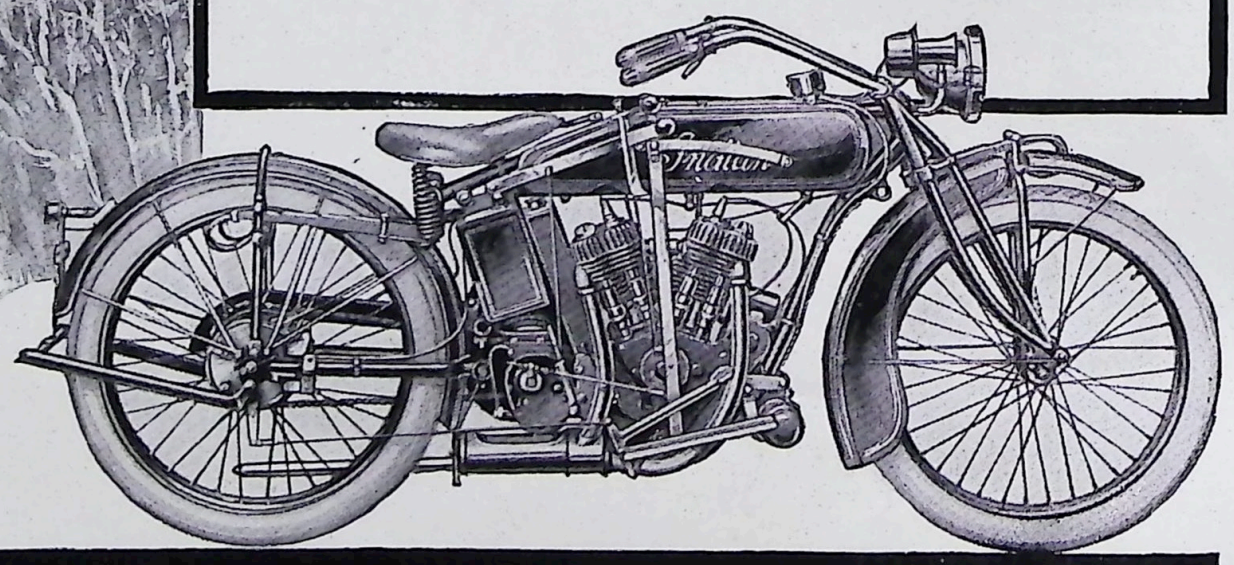

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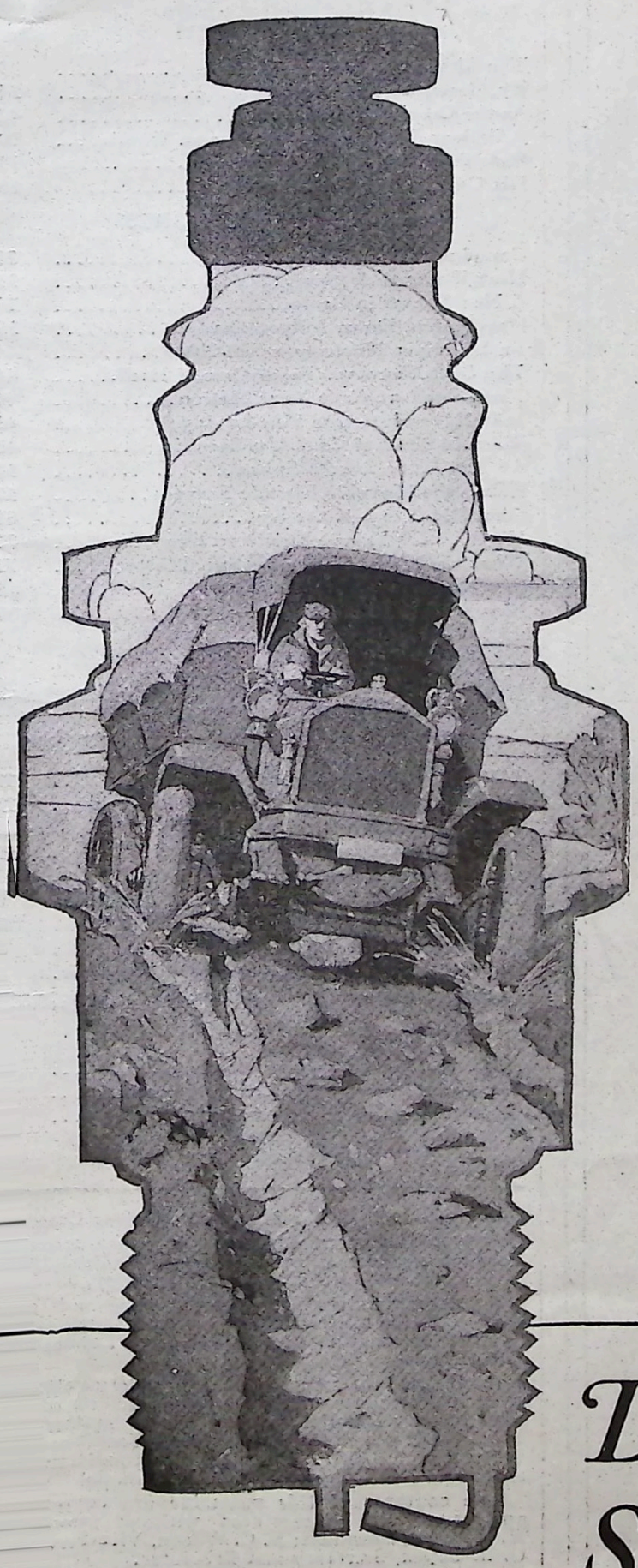

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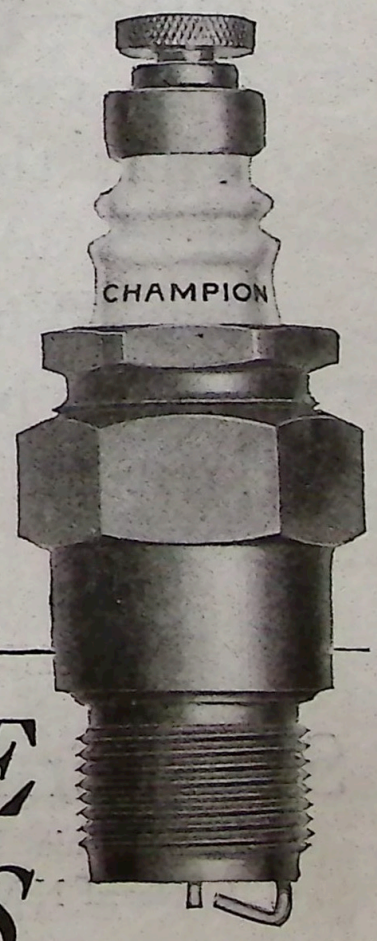

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Now, why not obviate the Watchful Waiting for decay to manifest itself in out-of-doors woodwork by making everything of Cypress, "the Wood Eternal," in the first place?

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All-round Helps Department

Southern Cypress Mfrs.' Ass'n.

1249 Hibernia Bank Building, New Orleans, Louisiana
1249 Heard National Bank Building, Jacksonville, Florida

Popular Science Monthly

NOV., 1920
Volume 97-No. 5

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H. J. Fisher, President; R. C. Wilson, Vice-President; O. B. Capen, Secretary and Treasurer.

Modern Publishing Company
225 West Thirty-ninth St. New York City

Little Signs That Reveal Character at a Glance

The Simple Knack of Knowing All About a Person at Sight

EVERY ONE knows that a high forehead indicates the intellectual type—that a receding chin denotes weakness, while a pronounced chin means determination—these things and a few other signs are understood by all. But often these signs are counterbalanced by others which are just as apparent but which the average person doesn't know how to diagnose.

As a consequence we often jump to conclusions about people, which prove incorrect because we don't carry our observations far enough. It's like trying to read a sentence by looking at the first one or two words. We might guess the sense but more likely than not we'd go wrong. Yet once you have the secret, you can understand what *all* the little signs mean and get at a glance a complete picture of the characteristics of every person you meet, as easily as you read this page.

I know this to be true for I used to be about the poorest judge of character that I know. I was always making friends only to find that they were the wrong kind, or saying the wrong thing to my customers because I had failed to "size them up" correctly, or lending money to people who never intended to pay me back. I even made a costly mistake by giving up a good job to go into partnership with a man who turned out to be little short of a thief.

I was pretty much discouraged by this time and I determined that the thing for me to do was to learn to read character, if such a thing as that was possible, for I felt that unless I did know whom I could trust and whom I couldn't, I never would get very far.

It was about this time that I read an article about Dr. Katherine M. H. Blackford, who is recognized as the foremost character analyst in this country, and who was employed by a big company at a record fee to select their employees. I thought then that if hardheaded business-men paid such a salary as this in order to insure their getting the right kind of workers that there sure must be something in character reading for me.

One day while in Pittsburg my eye was attracted to an announcement of a lecture on Character Analysis by Dr. Katherine M. H. Blackford and I decided to go and see if I could learn anything.

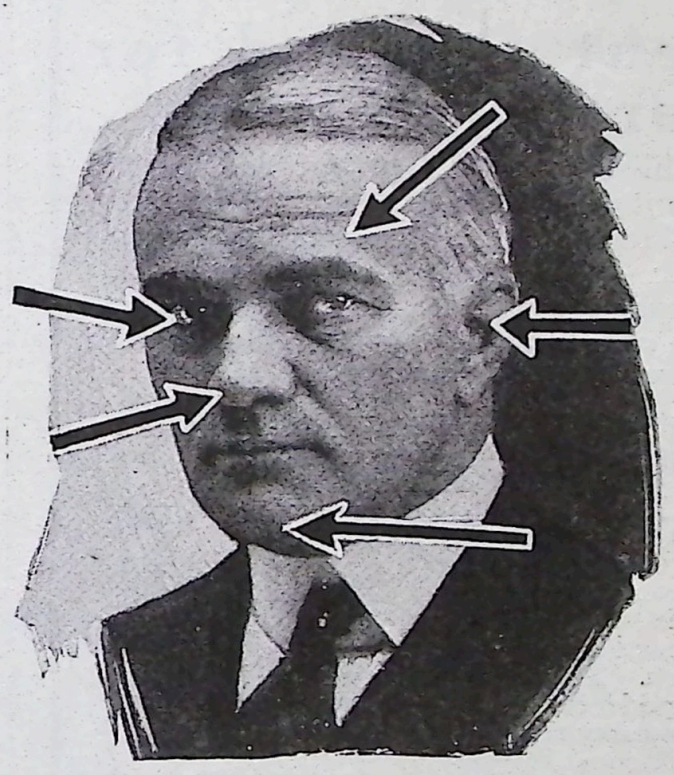
That lecture was an eye opener! Not only did Dr. Blackford show how easy it is to read at a glance the little signs that reveal a person's character, but after the lecture she gave a remarkable demonstration of character reading that amazed the audience.

She asked the audience to select two people in the hall to come up and be analyzed. Several men, all of them entirely unknown to Dr. Blackford, were suggested and finally two were chosen. As they came upon the platform Dr. Blackford looked them over keenly and, after a moment's thought, began to analyze both of them at once. As she mentioned the characteristics of one she described the corresponding characteristics in the other.

Beginning with generalities, she told the audience, every one of whom seemed to know both men, that one was a good mixer, aggressive, bold and determined, while the other was more or less of a recluse, very self-contained, quiet and gentle.

The first, she said, was brilliant, clever, quick-witted and resourceful; the second a silent man, slow and deliberate when he spoke, and relied upon calm, mature judgment rather than brilliant strokes of ingenuity and wit.

The first man according to Dr. Blackford was active, restless, always on the go, impatient, and able to express himself only in some active, aggressive manner. The second man was studious, plodding and constant, and expressed himself after prolonged concentration and careful thought. The



"What I've learned enables me to know as much about a man the first time I meet him as his best friends—sometimes more."

first man, the doctor said, was therefore especially equipped to execute plans, to carry to success any course of action, but was not particularly qualified to make plans or to map out a course of action—he could make practical use of many different kinds of knowledge but did not have the patience or the power of concentration to search out and classify the knowledge so that it could be used. While he was a brilliant speaker, a resourceful and effective debater, he lacked the power to dig out and assemble the material for orations and debates. The second man, she continued, being shy and self-conscious, could not speak in public, but was a master of study and research and strong in his ability to classify and correlate all kinds of knowledge.

"Indeed," said Dr. Blackford, "this gentleman would be a remarkable success as a lawyer, especially in court practice. The other gentleman would be a remarkable success as a lawyer, but his particular field would be the preparation of cases and the giving of counsel to clients. Therefore," she went on, "they would be particularly fitted to work together as partners not only because they complement each other professionally but because their dispositions are such that they would naturally admire and respect each other."

As she said this the audience broke into a storm of applause and upon inquiry I learned that the two men were indeed lawyers and partners, that they had been partners for twenty years and were well known in Pittsburg for their intense affection for each other and for the fact that during their twenty years partnership they have never had a disagreement. One was the brilliant trial lawyer; the other the student and counselor, and as a team they were remarkably successful.

When the lecture was over it didn't take me long to get up to the platform and inquire as to how I could learn more about character reading, and I found that Dr. Blackford had just completed a popular Course that explained the whole thing and which would be sent on approval without charge, for examination. I immediately wrote the publishers and received the Course by return mail.

And when it came I was never so amazed in my life—for here was the whole secret in seven fascinating lessons. No hard study—no tiresome drudgery, just interesting pictures and simple directions that I couldn't go wrong on.

Why, the very first lesson taught me pointers I could use right away, and it was only a matter of a few weeks before I was able at one quick but careful survey to tell just what a man was like by what he looked like.

And what a revelation it was! For the first time I really knew people whom I thought I had known for years. It was all so simple now that it hardly seemed possible that I could have made such mistakes as I did before I heard of Dr. Blackford.

People took on a new interest. Instead of just "blanks" each one became a definite personality with qualities, tastes and traits which I was always able to "spot." Why, the very act of meeting people became the most fascinating pastime in the world. And how much more clearly my own character loomed up to me. I knew as never before my limitations and my capabilities.

But it has been in my contact with people in business that my new faculty has helped me most—to say that it has been worth thousands of dollars to me is to put it mildly. It has enabled me to select a new partner who has proved the best help a man ever had—it has made it possible for us to build up probably the most efficient "frictionless" organization in our line of business with every man in the right job—it has been the means of my securing thousands of dollars' worth of business from men I had never been able to sell before because I hadn't judged them correctly, for after all salesmanship is more in knowing the man you're dealing with than in any other one thing—and what I've learned from Dr. Blackford's lessons enables me to know as much about a man the first time I meet him as his best friend—sometimes more.

Is it any wonder that such concerns as the Scott Paper Company, the Baker-Vawter Company, the Westinghouse Electric and Manufacturing Company, and others have sought Dr. Blackford as counselor; or that thousands of heads of large corporations, salesmen, engineers, physicians, bankers and educators have studied her Course and say that the benefit derived is worth thousands of dollars to them?

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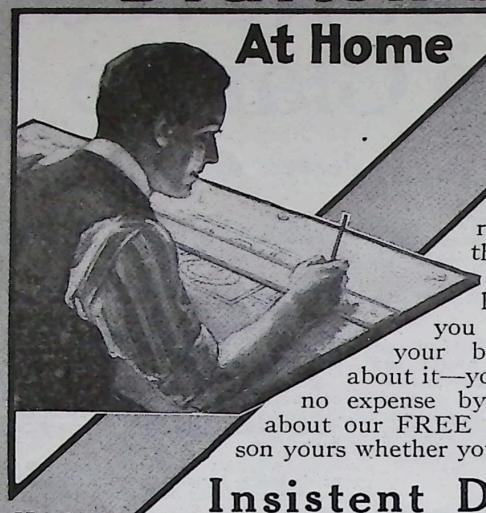

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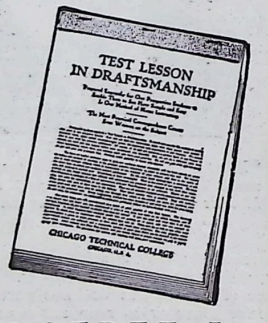

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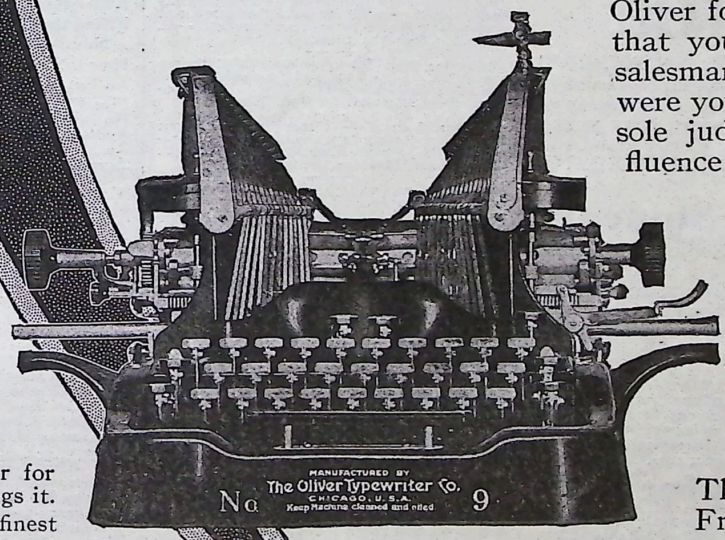

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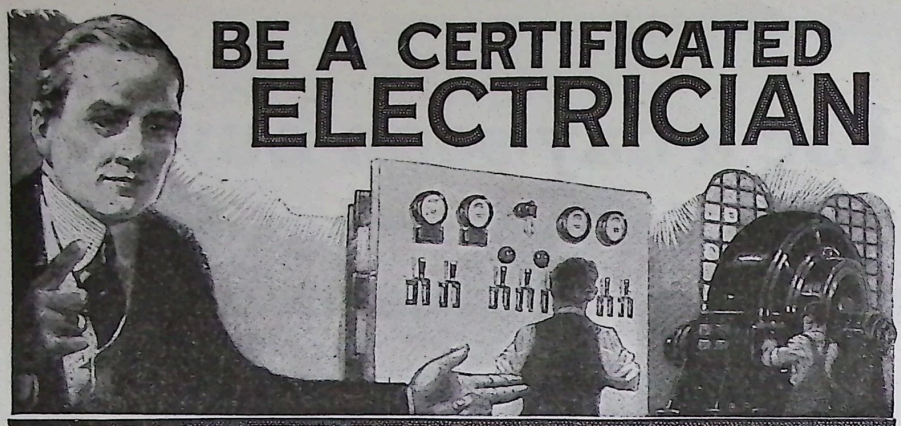

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I give each of my students personal attention and a complete and thorough training. I give him a SPLENDID ELECTRICAL OUTFIT FREE, and much of the training is done by actual work. When my students graduate and receive their certificate they are ready for a real position. But **still more**, at any time you wish you can come to our splendidly equipped Electrical Shops for special training. No other school can give you this.

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Wishing is never going to make your dreams come true. You've got to **study**—to **learn**. A man is worth only $2 or $3 a day from his neck down—and no more; but there is **no limit** to what he can be worth from his neck up.

A **trained mind** is what gets the big pay. It is this training that you need, and I can train you in a few months. Are you ambitious to make a real success? Then send me the coupon—today.

Electrical Outfit Free

To every student who answers this ad. I am giving a splendid Electrical Outfit of standard size Electrical Tools, Instruments, Materials, etc., **absolutely free.** Furthermore, to every Electrical Student I give a truly **valuable** surprise that I cannot explain here.

Free Employment Service

I am continually receiving requests from employers to send them trained Electrical men. I assist my students to secure good positions. I keep in touch with them for years, helping and advising them in every possible way.

WRITE NOW—DON'T DELAY

Delay never got you anything. Action is what counts. Get started—and get started now. Write me or send me this coupon right NOW.

L. L. COOKE, Chief Engineer

CHICAGO ENGINEERING WORKS

DEPT. 30X

1918 SUNNYSIDE AVE., CHICAGO, ILL.

USE THIS "FREE OUTFIT" COUPON

Chief Eng. Cooke,

Dept. 30-X
1918 Sunnyside Ave.,
Chicago, Ill.

Sir: Send at once—fully prepaid and entirely free—complete particulars of your great offer for this month.

Name .....

Address .....

City .....State.....

READ WHAT MY STUDENTS SAY:

"I would not take 1,000 dollars and be without your course. If I did the years ahead would only be like the few that have passed." —H. Swiger, Wallace, W. Va.

"Have been made Chief Electrician for the Michigan Carbon Works. Give your course all the credit, and am doing fine."—A. F. Klemz, Detroit, Mich.

"You will be pleased to learn of my promotion to Chief Electrician. It was your course put me where I am. Although only a little over half through your lessons, I have had my wages raised from $75.00 to $375 a month, and expect to do better before I am through."—H. E. Wolf, Columbus, Ohio.

"During May I made about $65.00 in my spare time. I can hand you the credit because when I started I knew NOTHING about Electricity."—L. Randell, Ironton, Minn.

"When I enrolled—I knew nothing about Electricity. Today I am the highest paid workman for the Massena Light & Power Co."—C. C. Burkhart, Massena, N. Y.

"When I enrolled I was skeptical. Now I am convinced you have a fine method of teaching and can, and will, do all you say."—John McGee, New York City.

"Since I started studying with you a year ago I have been doing small electrical jobs; made the price of two Courses outside of my regular work, or 200 per cent on my investment. Your Course has also increased my earning power 100 per cent."—Samuel E. Albright, Riverside, Wash.

"When I enrolled with you I was only able to make $75.00 a month. Today, thanks to your splendid lessons, I am in business for myself, making over $400.00 a month."—A. Schreck, Phoenix, Arizona.

"In the past ten years I've been doing a lot of studying, both by correspondence and through text books, but never before have I been able to learn as I have with you.' —J. B. Ham, Chief Electrician, Albright Coal Co., Tunnelton, W. Virginia.

"You don't know how glad I am that my son had found such a man as you. I only wish other mothers knew of the interest you take in your students—their boys."—Mrs. S. S. Williams, Huntington Beach, Cal.

"Mr. Cooke can, and will, get you a job, but that part is unnecessary, because, if you study, he will make you proficient, and then there will be any number of jobs LOOKING FOR YOU." —O. W. Chamberlain, Little Eagle, So. Dak.

"I am still holding that position with the Minneapolis Steel & Machinery Company, secured on your recommendation."—A. Swanson, Minneapolis, Minn.

"The outfit is wonderful, so much better than I expected, and I must say I am more than pleased with same."—F. X. Droege, Covington, Ky.

"Must compliment you on the very thorough instruction given in motors and motor maintenance. I am an old hand at this work and know when things are well handled."—B. G. Dahl, Fort Terry, N. Y.

"Your Course of Study has done a great deal for me. When I enrolled I was working for somebody else, but now I am in business for myself, a Licensed Electrical Contractor, and have five men and a helper working for me."—Jos. A. Stueber, St. Louis, Mo.

"Although only 16, and still in school, I am now a Licensed Electrical man, and in business for myself. Have averaged $20 to $30 a week on work done after school hours, and on Saturdays."—Roger Smith, Greenville, N. C.

Complete Letters Sent When You Write Me

YOU CAN DO IT

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Earn Big Money!

Expert Mechanics Wanted In Auto & Tractor Business

E. J. SWEENEY
President

COME to the Sweeney School of Auto, Tractor and Aviation Mechanics if you really wish to be a trained Expert and to work on the most modern machinery. Come today for tomorrow never comes. Pack your grip and let's go.

$150 to $400 a month

The Million Dollar Sweeney School is preparing men to earn from $150 to $400 a month in the Automobile and Tractor business. Take the TIRE business for instance. Big money in that. I teach you the whole business thoroughly. How to sell. How to repair. How to make tires. How to take a few cents' worth of Junk and make a $35 tire. The state of Missouri alone bought $25,000,000 worth of tires last year. **The going's good.** Be an expert. No previous experience needed—if you are mechanically inclined the Sweeney System trains you in 8 weeks.

PICK YOUR JOB

Farm Mechanics $100 to $200 mo.

Motor Experts	$125 and up
Tire Vulcanizers	$125 and up
Chauffeurs	$100 and up
Welding Experts	$150 and up
Repair Men	$1.25 per hour
Truck Drivers	$35 per week
Taxicab Drivers	$25 per week
Trouble Shooters	$3 per hour
Salesmen	$3,500 per annum
Tractor Engineers	$8 per day
Garage Manager	$3,000 a year

FACTS ABOUT THE SWEENEY SCHOOL

Over 187 acres shop and operating space.

Over 1 Million Dollars invested. Equipment alone worth over $350,000, of which $50,000 machine shop and aviation equipment has just been purchased.

Over 1,200 students and 35,000 graduates.

250 instructors and employees; monthly pay roll $30,000.

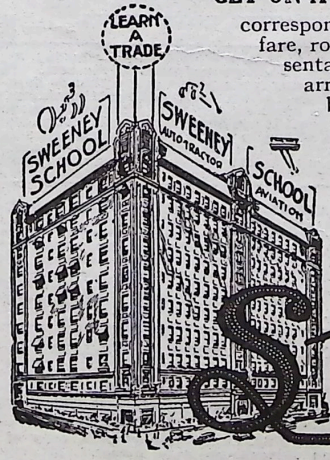
The Sweeney System cannot be obtained anywhere else, just as Sweeney's Equipment is unsurpassed. Learn how to repair or make any piece of machinery by doing the work with your own hands under the personal instruction of experts. Train hand and eye and brain together until you do the job right. This is the celebrated Sweeney System that has turned out over 35,000 graduates and which was approved by the United States Government in sending me 5,000 men to train for army mechanical service. The idea that has built a Million Dollar Trade School and made thousands of men a success in life. We're ready for you—and a bigger, better job.

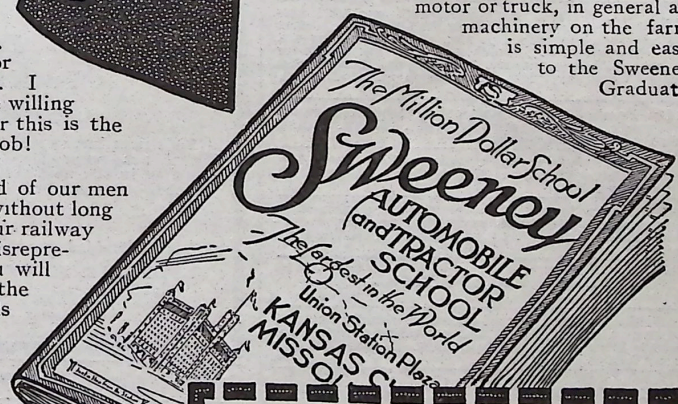
FARM BY MACHINERY

On our great Tractor Farm you learn by actually handling over 18 different makes of Tractors. You learn all about Stationary engines; principles of lighting plants, how to fix up any motor or truck, in general all machinery on the farm is simple and easy to the Sweeney Graduate.

If You Are Discontented

Remember that you can't succeed unless you like your work. But if you like it you find it easy to make good. If you are mechanically inclined write me today. But, if not, don't bother me. You don't need books. You don't need education, but you do need a natural liking for mechanics. I teach you by WORK. You use tools not books. I made a success out of a deaf and dumb man. But, unless you are willing to get grease and grime on your hands you can't learn here, for this is the school of experience. We're ready for you—and a bigger, better job!





GET ON A TRAIN—LET'S GO. One-third of our men come here straight off—without long correspondence. I guarantee to refund your railway fare, round trip, if you find a single misrepresentation. Simply tell me when you will arrive, and you'll find your name on the bulletin board, class assigned, tools ready for you, room waiting you. Only white students accepted.

PACK YOUR GRIP AND LET'S GO.

Earnestly yours,
EMORY J. SWEENEY, President

EMORY J. SWEENEY, President
800 Sweeney Building, Kansas City, Mo.

Send me free your 72-page catalog and Sweeney School News and tell me of the opportunities in the auto and tractor business.

*Name*_____

*Address*_____

*I'm Coming*_____

LEARN A TRADE—Sweeney
SCHOOL OF AUTO-TRACTOR-AVIATION
800 SWEENEY BLDG. KANSAS CITY, MO

QUICK-ACTION ADVERTISING

HERE READERS AND ADVERTISERS MEET TO TRANSACT BUSINESS

Rate 30 Cents a Word. Advertisements intended for the January issue should be received by November 1st.

AUTOMOBILES AND ACCESSORIES

AUTO MOTOR SUPPLIES—Buick, Michigan, Stoddard Dayton, Cadillac, Overland, E. M. F. Continental and Buda Motors all types $50 each and up. Special high tension 2 and 4 cylinder magnetos $9.50 each. Electric and gas head lamps, coils, carburetors, air compressors, generators, starters, etc. Write for catalog. Address Motor Sales Dept. (14) West End, Pittsburgh, Pennsylvania.

AUTOMOBILE Parts for all cars—50% off manufacturers' list price. Pistons, connecting rods, cam shafts, crank shafts, cylinders, axles and gears. Our new catalogue and Used Parts Bulletin now ready. Write for it to-day. Service and satisfaction guaranteed. Auto Parts Company, 4108 Olive Street, St. Louis, Missouri.

Vulcanizing auto tires is a growing and profitable business. Easy to learn. Instruction book, $1. Plants $50 to $300. Details free. Equipment Co., 17 Canal, Cincinnati, Ohio.

PATENTS—Write for Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch and description of invention for our opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 189 Ninth, Washington, D. C.

BIG profits to agents selling Insurt Tires. Double mileage. Prevent blowouts and punctures. Fully guaranteed. Fast seller. Liberal profits to agents. Autocessory Sales Co., G 542 W. Jackson Blvd., Chicago, Illinois.

BULL dog inner tires molded to fit your casings. Practically eliminates blow-outs and punctures. Doubles the life of your tires. Wonderful seller and repeat order getter. Write for particulars to-day. Agents making $5,000 to $10,000 a year. Eastern Auto Specialty Co., Dept. B, Utica, New York.

AUTO-TOP and seat covers, $7 up, parcel post, prepaid. Easy to apply. Catalogue and samples free. Auto Equipment Company, 20 Canal, Cincinnati, Ohio.

BLUEPRINTS—Automobile generator armatures. See ad under "Electrical." Charles Chittenden.

YOU can buy your favorite tires direct by mail at wholesale price and eliminate the dealer's profit. Don't purchase another tire until you receive our free wholesale price list on new standard tires. Write immediately. Akron Tire Sales Co. (Dept. P), Davenport, Iowa.

SPEEDSTER and Racing bodies. Build your own—save over half. Floege's System of Auto-Body Building, Dept. D. North Chicago, Illinois.

INSYDE Tyres, inner armor for automobile tires. Prevents punctures and blowouts; doubles mileage of any tires. Liberal profits. Details free. American Accessories Co., Dept. 97A, Cincinnati, Ohio.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

FORD ACCESSORIES

FORDS run 34 miles per gallon with our 1920 carburetors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all motors. Runs slow in high gear. Attach yourself. Big profits for agents. Money back guarantee, 30 days' trial. Air-Friction Carburetor Company, 500 Madison Avenue, Dayton, Ohio.

TIMER Brush. New wiping contact; quick starting; easiest running. Only 34 cents, prepaid. R. Sp. Works, Box 543, Riverside, California.

FORD spark plug cores, complete, 17c; four, 58c. Specialty catalog with order. Milron Co., 242 East 235th Street, New York City.

FORD Valve adjusters make your Ford engine absolutely quiet, give more power, saves gasoline. Price complete set $1.00. Leitner Mfg. Company, 4430 Bernard, Chicago.

WELDING AND SOLDERING

WELDING apparatus for all purposes. Small payment, balance five to ten months. Every mechanic needs one. Our plan is interesting. Write to-day. Bermo Welding Co., Cedar Rapids, Iowa, U. S. A.

MOTORS, ENGINES, MACHINERY

SMALL Motors and Generators, ¼ h. p. a. c. $26.50, ½ h. p. $38.50, ¾ h. p. a. c. $67.50. Battery charging sets. Charging lighting and moving picture arc generators. Motors for all phases of current. Prompt delivery. Wholesale prices. Write for late catalog. Address Motor Sales Dept. (14), West End, Pittsburgh, Pennsylvania.

WIRELESS

SIMPLE Wireless Telephones and How to Make Them. A good book for the advanced radio amateur on the principles, construction and use of the wireless telephone. Price 25 cents postpaid. Book Dept., Popular Science Monthly, 225 West 39th Street, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

ELECTRICAL

BLUEPRINTS: 104 induction motor diagrams, Poles to 12. Single, Two and Three phases. Price $3.00. International Blueprint Company, Station "B," Kansas City, Missouri.

ELECTRICIANS, Wiremen, Linemen, send your name and address for descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Over 350 practical diagrams. Electrical Wiring Diagram Company, Box B173, Altoona, Pennsylvania.

MAKE Dry Batteries. Simple, practical instructions, with blue print, 25 cents. Dirigo Sales Company, Bath, Maine.

BLUEPRINTS—Electrical connections. Alternating and direct current motors, transformers, rheostats, controllers, compensators, automobile generator armatures. 10 samples A. C. 25c. Catalog free. Charles Chittenden, S3024 Matthews Avenue Kansas City, Missouri.

What About the Rate?

Now and then we hear an advertiser remark that the rate in Popular Science Monthly is "a little high." Invariably it is the man who has never used the magazine who brings up the question. Those who are using it every month know that the rate is a secondary factor, for the majority of them have found that the results they get are way above the average of other publications charging even a higher rate. In other words, if it pays, it pays, and unless it does exactly that the rate isn't worth considering. But the fact that 80% of the advertisers who were using space in 1915 are still represented in every issue proves that the results are direct, profitable and continuous. Here's a concrete example:

"Received yours stating that you were going to boost the rates. As a consistent advertiser for six years, will say that you can go as far as you like, because I receive more answers and MORE ORDERS from Popular Science Monthly than any publication I advertise in, and that is nearly all the big ones. Run copy enclosed T. F."

Yours,

IRVIN DANIEL WOLF.

This man knows what he is talking about. He is not guessing. Why don't YOU put your ad in the next three issues and be convinced? You will be.

Classified Advertising Manager
POPULAR SCIENCE MONTHLY
225 West 39th Street
New York City

WANTED

CASH: Paid! If you want all your goods are worth, mail us your discarded jewelry, gold crowns, bridges, watches, diamonds, silver, platinum, magneto and contact points. We pay $1.00 to $25.00 per set for false teeth (broken or not)—Money sent by return mail. Packages held 5 to 12 days and returned at our expense if our offer is not satisfactory. Send to the old Reliable United States Smelting Works, Dept. 81, Chicago, Illinois.

WANTED—Representatives in every Factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

WANTED—Small gasoline and steam engines, electric drills, motors, etc. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pennsylvania.

WANTED a copy of "How to Make Things Electrical." If you have a copy of this book you will sell, write giving the date of copyright. Book Dept., Popular Science Monthly, 225 West 39th Street, New York.

MAIL Directly to the Refiners any old gold, silver, magneto points, old watches, diamonds, platinum, old or broken jewelry, false teeth, gold or silver ores or nuggets, war bonds and stamps. Send them to us to-day. Highest prices paid in cash by return mail. Goods returned in ten days if you are not satisfied. The Ohio Smelting & Refining Company, 238 Lennox Building, Cleveland, Ohio.

AVIATION

THE American School of Aviation announces a new correspondence course in Mechanics of Aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 1898, 431 South Dearborn Street, Chicago.

HEATH Airplane Co.'s Catalog "N" is the most complete booklet ever published on aeronautical needs, 12c in stamps. Get our pamphlet on Ford and Motorcycle engine-driven airplanes, 4c; also glider circular, 4c. We buy and sell all kinds of aeronautical motors. Heath Airplane Co., Chicago.

SPORT BIPLANE—Ford motored. Build or assemble your own at low cost. Parts for one wing, $25. Parts for body, $60, Etc. Engines, $250. Plans and very complete instructions for building, only $5. (You will learn a lot about aircraft mechanics). Aviation Engineering Co., Lawrence, Kansas.

INVENTORS desiring information write for our Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 151 Ninth, Washington, D. C.

BUILD the Star Jr. Biplane. Send stamp for Circular "P." Chicago Aero Works, 326 River.

"MOTORCYCLE ENGINED" Monoplane. Very efficient for learning flying. Materials cost about $50. Plans and instructions for building and flying, $1. Aviation Directory, Lawrence, Kansas.

MOTORCYCLES, BICYCLES, SUPPLIES

MOTORCYCLES $40.00 up; Side Cars, Evans Powercycles. Johnson Motor Wheels, and other light motor attachments. Send for our Big Bargain Bulletin and our "Money Saving Message to the Motorcyclist" (illustrated). It will save you money, on motorcycles, side cars, bicycles, repair parts, tires, and supplies. Our Repair Department is at your service. American Motor Cycle Company, Dept. 8, Chicago.

$25.00 Up—Guaranteed rebuilt motorcycles—Henderson, Excelsior, Indian, Harley-Davidson. Bicycles, $5.00 up. Tires and accessories at wholesale. Illustrated bulletin "A" free. Ash Motor Corporation, 162 North Clinton Avenue, Rochester, New York.

USED Motorcycle Bargains: Indians, Excelsiors, Harleys. $40.00 up. Singles or twins. Overhauled, rebuilt and tested by experts. Shipped on approval and guaranteed. Send stamp for Big Free List. We furnish bank references. Floyd Clymer, Desk A, "Largest Motorcycle Dealer in Western America," Denver, Colorado.

MANUFACTURING

WE do Metal Stamping, Die and Model Work, Gold, Silver, Nickel, Copper and Brass Plating; also special finishes. We will manufacture your article either on straight time or contract basis. When our tool or model maker is on your job, you are welcome at his bench. Denning Manufacturing Company, 1775-1777 East 87th Street, Cleveland, Ohio.

FORMULAS

DEPENDABLE formulae for Automobile, Toilet and Food Specialties, including Industrial Processes. Lists 2c. Industrial Methods Bureau, 1B West 34th Street, New York City.

500 FORMULAS. Trade Wrinkles, Secrets, Discoveries. All easy, successful money-makers. Lists free. Everything 25c. Edgar James, 315 Douglass, Indianapolis, Indiana.

FIFTY crackerjack formulas—no impractical antiques—automobile specialties, enamels, polishes, cements, etc., fifty cents. Emdon Specialty Bureau, P. O. Box 406, Brooklyn, New York.

FORMULAS worth while having! Secure list before buying. Send 4c to cover expense. Dept. 10, Martinek Paint Co., 405 Lexington Avenue, New York.

DRAWING INSTRUMENTS

200 COMPLETE sets of Mechanical drawing instruments must be Sacrificed regardless of the cost. These mechanical drawing sets must be sold within 30 days—at less than wholesale prices. You will save the wholesaler's profit and the retailer's profit by taking this wonderful opportunity now. If you buy now you will get the biggest bargain ever offered in mechanical drawing instruments. Send for our illustrated particulars—free. National Instrument Company, 4517 North Lawndale Ave., Chicago, Illinois.

LABORATORY AND CHEMICAL SERVICE

EXPERIMENTAL Chemistry set for young people. 28 chemicals and 12 pieces of apparatus, in wooden box with book of instructions and experiments. Everything the very best quality. Price $5.50. Stamp for illustrated lists. Bathe Mfg. Company, Desk 6, 5214 Woodland Avenue, Philadelphia.

MODELS AND MODEL SUPPLIES

PATENTS—Book free. Send sketch for free Opinion of patentable nature. Talbert & Talbert, 4848 Talbert Building, Washington, D. C.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

Quick-Action Advertisements continued on page 10

"Find the Man!"

"We'll pay him $5,000 a year. Go over our list of employees—pick out those who not only have been doing their work well, but have been studying in spare time getting ready for advancement. That's the kind of man we want for this job and for all of this firm's responsible positions."

Employers everywhere are combing their ranks for men with ambition, for men who really want to get ahead in the world and are willing to prove it by training themselves in spare time to do some one thing well.

Prove that you are that kind of man! The International Correspondence Schools are ready and anxious to help you prepare for advancement in the work of your choice, whatever it may be. More than two million men and women in the last 29 years have taken the I. C. S. route to more money. More than 110,000 others are getting ready right now. Hundreds are starting every month. Isn't it about time for *you* to find out what the I. C. S. can do for you?

Here is all we ask: Without cost, without obligating yourself in any way, simply mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 7699,, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Railways
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN OR ENGINEER
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ Ship Draftsman
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Textile Overseer or Supt.
- ☐ CHEMIST
- ☐ Mathematics
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Window Trimmer
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ Railroad Trainman
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BUSINESS MANAGEMENT
- ☐ Private Secretary
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Public Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERATING
- ☐ Auto Repairing
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

Canadians may send this coupon to 7-25-19
International Correspondence Schools, Montreal, Canada

AMERICAN MADE TOYS

AN opportunity for homeworkers on small scale and manufacturers on large scale to make American Metal Toys. Army, Navy, Machine Guns, Cannons, Warships, Indians, Cowboys, Wild Animals, Whistles, Bird-whistles, Religious designs and other toys and Novelties. Greatest chance for industrious people to have an independent business. Enormous demand for cheap toys offers unlimited field and great future all over United States and foreign countries. Experience or tools not necessary. Hundred and more made complete per hour. Casting forms, complete outfit from $3.00 up. We buy these goods paying fixed prices. Attractive prices offered for painted goods. A strictly business proposition. No one need apply unless he means business. Booklet and information furnished free. We have no sales agents and we warn against worthless and cheap imitations. Toy Soldier Manufacturing Company, 32 Union Square, New York.

AUCTIONEERS

AUCTIONEERS and Bankers make big money. We teach both. Free catalog. Missouri Auction Banking School, Kansas City.

DUPLICATING DEVICES

"MODERN" Duplicator—a Business Getter, $2.25 up, 50 to 75 copies from pen, pencil, typewriter; no glue or gelatine. 35,000 firms use it. 30 days' trial. You need one. Booklet Free. J. V. Durkin & Reeves Company. Pittsburgh, Pennsylvania.

KEY DUPLICATING MACHINES

DUPLICATE keys for all Yale and similar locks made in one minute with Harrison Key Filing Machine. No misfits. Thousands in use. Sent prepaid $5.00. Money returned if not satisfactory. Harrison & Company, 18 Broadway, New York.

FOR THE HOME

GRANDFATHER'S Clock Works $5.00. Build your own cases from our free instructions. Everybody wants a hall clock. You can make good profit building artistic clocks for your friends. We replace worn-out works in old clocks with works having chimes at money saving prices. Write for folder describing the most beautiful hall clock ever sold at $25.00. Clock Co., Nicetown, Pennsylvania.

"LITTLE WONDER" Crown Capping Machines sell to every housewife, equal in efficiency to expensive power machines. Fastest sellers. Agents, Dealers, write. Minkee, Dept. C., Alhambra, California.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MISCELLANEOUS

5 MASTER KEYS, $1.00. Opens hundreds of different locks. The world's most wonderful set of keys. Master Key Company, 34 Manhattan Building, Milwaukee, Wisconsin.

AVOID Income Tax Worry and confusion. Use Ley's Ready Records during year. $1.50 Complete. Copper Journal, Hancock, Michigan.

ELECTRICAL Tattooing Machine, $3, $5, and $7. Catalogue for stamps. J. H. Temke, 1019 Vine, Psm., Cincinnati, Ohio.

BALDNESS. Indian's recipe for growing hair; astonishing success. Proof box mailed for 10 cents. John Hart Brittain, 150 East 32nd Street, BA-118, New York.

IMMUNITY from infection. Use L-Wood Sanitary coverings for closet seats. Package containing 6, 15c postpaid. L-Wood, 460 Madison Avenue, Albany, New York.

PILES—For the latest scientific treatment write Elite Mfg. Company, 1004 Lawler Avenue, Auston, Chicago, Illinois.

GLASS SIGNS for rooms, furnished rooms, boarding, dress-making, cafes, restaurants, banks, offices, door name plates, house numbers, glass signs made to order. Write for price list. Penn Glass Sign Company, Fort Smith, Arkansas.

STILLS Water, liquids, all drinking purposes—half gallon hour. $15 prepaid. European Supply, Box 1682, Pittsburgh, Pennsylvania.

POULTRY Feeder, New principle. No waste. Sanitary. Booklet and Mash Formula Free. L. Kelly, Saranac, Michigan.

THREE pencils, your name in gold, Floral or Birthday Box, 35c. Stamps accepted. Send for Illustrated Price List. C. P. Damon, 441 Tremont Avenue, New York City.

MANSFIELD'S Automatic Water Finder has made fortunes for many men and may make yours. Send for particulars to Edwin Mansfield, 94 Victoria Road, New Brighton, England.

TELEGRAPHY

TELEGRAPHY (both Morse and Wireless) and Railway Accounting taught quickly. Tremendous demand. Big salaries. Great opportunities. Oldest and largest school; established 46 years. All expenses low—can earn large part. Catalog free. Dodge's Institute, K Street, Valparaiso, Indiana.

ADDING MACHINES

WONDERFUL Adding Machine, seven columns capacity, only two dollars. Adds and multiplies as fast as the fingers will move. Thousands being sold through demonstration. L. J. Leishman Company, Dept. L, Ogden, Utah.

MARVELOUS new Automatic Adding Machine. Retails $12.50. Work equals $300 machine. Five-year-guarantee. Write for trial offer. Calculator Corporation, Dept. P, Grand Rapids, Michigan.

STAMMERING

STAMMERERS: My simple and natural method will correct your impediments. Instruction individual. Samuel E. Robbins, 246 Huntington Avenue, Boston.

ST-TUT-T-T-TERING and Stammering cured at home. Instructive booklet free. Walter McDonnell, 59 Potomac Bank Building, Washington, D. C.

PRINTING, ENGRAVING, MULTIGRAPHING

MULTIGRAPH Letters build business. Most economical and effective advertising. Printing. Addressing. Low rates; careful work; service. Multigraph-Peerless Letter Company, 241 Fourth Avenue, New York.

833 FT. LABELS, $2.50. Save 30% on all. Wolf Labels, Station E, Philadelphia.

100 Cards, business, professional or social, also imitation leather card case, for 60 cents. M. F. Devaney. Printing, Engraving, Rubber Stamps, 31 Middle Street, Geneva, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

LETTERHEADS $2.5 thousand. Samples free. Quality Print Shop, Marietta, Ohio.

BUSINESS and Name Card specimen sheets on request. Star Press, Box M37, Winchester, New Hampshire.

1,000 LETTERHEADS, envelopes, cards, etc., $3.00 and less. P. S. Orvis, Hackensack, New Jersey.

GOOD Printing Reasonable. Machine composition, automatic printing presses, automatic envelope machinery. We print anything. Get our prices. A. H. Kraus, Kraus Building, Milwaukee, Wisconsin.

CITY printing at country prices. Write for samples and prices. Royal Printing Company, Sugarcreek, Ohio.

BETTER printing for less money! Send for our large package of samples of hundreds of items every user of printing is interested in. These samples worth dollars, will be sent for 10 cents to pay postage. Ernest Fantus Company, 525 South Dearborn Street, Chicago.

500 TWO-COLOR bond letterheads or envelopes, $2.50. Samples, 2c. "Mailpress," 3125 Wentworth, Chicago.

GUMMED labels! Rubber stamps! Catalog free. Edward Harrison, "Printing," Baltimore.

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SAVE 60% on engraving by using our Non-Plate Engraving Process. 50 wedding invitations, engraved, with double envelopes, $6.75. 100 visiting cards engraved, 75c postpaid. Office stationery, business announcements, etc. Samples and prices furnished upon request. Alden Non-Plate Engraving Company, 15 Avon Street, Boston, Massachusetts.

100 CARDS, business, professional, or social, card-case free, 75 cents. Agents wanted. G. B. Pratt, 68 Madison Street, Cortland, New York.

TYPEWRITTEN letters reproduced. Write for prices and samples. Joseph McGann, 1345 Park Road, Washington, D. C.

50,000 4-page, 6x9 circulars, Warren's Paper, $135.00. Other circulars proportionate. Times Printery, St. Francisville, Illinois.

ADVERTISING SERVICE

ADVERTISING prepared and placed in any publication. Letters, circulars, booklets written, illustrated and printed. Douglas Wakefield Coutlee, 1A West 34th Street, New York.

1,000 Advertising Headlines and Showcard Suggestions. Inspiration for advertisers. Mailed on receipt of 50c. Money back if you return book. Richards School of Advertising, 4305 Cottage Grove, Chicago.

SPECIAL! Inch display advertisement 150 magazines thrice $15. Globe Syndicate, Atlantic City.

ADVERTISE in 24 big Iowa dailies, 25 words $10.00; "They Pull." Advertisers Guide, free. Union Advertising, Baltimore Building, Chicago.

18 WORDS in 100 Magazines, $1.00. Lists Free. Stanford Corporation, Lancaster, Pennsylvania.

1000 CO-PUBLISHERS wanted! Terms—Registration, $3. Globe Syndicate, Atlantic City.

LETTER SPECIALISTS

THE Secret of Writing Successful Letters revealed to you by Ad-Man Davison, the highest-paid letter writer in the world. Wonderful 976-page instruction course, including 500 successful letters. For Free Booklet address Desk 60, Opportunity Press, 681 Fifth Avenue, New York.

MAILING LISTS

$2.00 for 2100 mail order buyers, farmers, property owners, compiled from our private inquiries, orders, records July, 1920. Exceptional opportunity for all interested. Dept. 36, Martinek Paint Co., 405 Lexington Avenue, New York.

OFFICE AND FACTORY EQUIPMENT

MULTIGRAPHS, Duplicators, Addressing, Folding, Sealing Machines. Bought, Sold and Rebuilt. Guaranteed. Office Device Company. 154A, West Randolph, Chicago.

MULTIGRAPHS, Addressographs, Duplicators, Sealers, Folders, less than half price. Guaranteed one year. Pruitt Company, 112-M North La Salle, Chicago.

ADDRESSOGRAPHS, Multigraphs, Duplicators, Folders, Sealers, Bought. Sold with Guarantee. Office Device Exchange, 503 Baltimore Building, Chicago.

TYPEWRITERS AND SUPPLIES

NEW, remanufactured and slightly used Typewriters $8.00 up. Portable Machines $10 up. Write for our Catalog 25-K, Beran Typewriter Company, 58 West Washington Street, Chicago.

FOREIGN LANGUAGE STUDY

SPANISH Language, most practical individual instruction by correspondence, $7.00 Monthly. Prunera's Spanish Studio, 180 Broadway, New York. (Established 1903).

POULTRY AND LIVE STOCK

RAISE poultry and rabbits—we tell how. Great rabbit book, 25c. Paper $1.00 year; both $1.15. Sample free. Poultry Advocate, Dept. B-42, Syracuse, New York.

FOR MEN AND WOMEN

MEN or Women—Enormous Profits Selling Duo Guaranteed Products. Easy sales at every house. All or spare time. Outfit free. Write quick. Duo Company, Dept. H66, Attica, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Missouri.

GENUINE Indian Baskets—Wholesale. Catalogue. Gilham, Highland Spring, California.

"SEXUAL Philosophy," 12c. Clear, specific, authoritative, complete, best, satisfies. Fred B. Kaessmann, Lawrence, Massachusetts.

MAKE $19.00 Hundred Stamping Names on Key checks. Send 25c for sample and instructions. PS Keytag Company, Cohoes, New York.

DETECTIVES—Excellent opportunity. Fascinating work. Experience unnecessary. Particulars free. Write. American Detective System, 1968 Broadway, New York.

SEX books for advanced adult students and professionals. The most authoritative sex books including Kisch, Forel, Krafft-Ebing, etc. Send for list. Modern Book Society, 5 Hanson Place, Brooklyn, New York City, Desk 16.

DOGS, BIRDS, PETS

READ the Rabbit Journal, St. Francis, Wisconsin. Two years, $1. Trial Subscription 25c.

BREED Canaries—Profitable pastime. Particulars free. Bird Farm, Lynnhaven, Virginia.

AIREDALES, Collies and old English shepherd dogs. Puppies all ages. Rabbits, Poultry, thoroughbred stock. Send 10c for list of what you want. W. R. Watson, Box 225, Oakland, Iowa.

EDUCATIONAL AND INSTRUCTION

HOME STUDY leading to usual degrees (including Pharmacy), School founded, 1897. 700 graduates. Lincoln-Jefferson University, Box 239-G, Chicago, Illinois.

DOUBLE-ENTRY Bookkeeping mastered with 8 Keys in 60 hours; guaranteed; diplomas; twenty lessons $5. International Bookkeeping Institute, Springfield, Missouri.

PICTURES AND POSTCARDS

SPECIAL—Twenty clever, classy, assorted postcards 10c. prepaid. Swanson, 1205S Kansas Avenue, Kansas City, Kansas.

EVERYTHING in postcards. Live-wire list free. Worth-while samples 25c. Mention subjects preferred. Mutual Supply Company, Bradford, Pennsylvania.

JOIN Live Postcard Club. Membership Papers 10c. Harvey Teeple, Decatur, Indiana.

JOIN the Western Post Card Club. P. Fleming, Manager, Elk, Washington.

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ELECTRICAL BOOKS

WIRING is made easy for anyone with an elementary knowledge of electricity by the use of Sengstock's Electricians' Wiring Manual. Just follow the simple instructions in this manual and Do Your Own Wiring. The book is written in plain English within the grasp of any one. You need not worry about your wiring passing inspection if you have this manual. Pocket size, flexible binding. Price, postpaid, $2.50. Popular Science Monthly, 225 West 39th Street, New York.

DO you have the 110-volt alternating current in your home? Would you like to know something about the most common form of electricity in commercial use? Then get a copy of Adams' "Experiments with 110-Volt Alternating Current." You will be amazed when you learn how many interesting experiments can be performed with home-made apparatus and how in a short time you can become thoroughly familiar with the 110-volt alternating current. 135 illustrations showing exactly how to make the apparatus and perform the experiments. Price, postpaid, $1.75. Popular Science Monthly, 225 West 39th Street, New York.

PATENTS FOR SALE

PATENT No. 1,294,881 Electric Floor and Carpet Washer. R. Dickinson, Appleton, New York.

PATENTED article of metal for office and household use for sale; good seller, very ornamental and useful; cost about 20c, sells for $1.00. Send for pamphlet. H. R. Ford, South Jacksonville, Florida.

PATENT 1297399, wish market or sale same outright. George Pratt, Box 1700, Richmond, Virginia.

FOR SALE—Patent outright or royalty, Automobile Fender; new safety device to protect lives. M. Wilkenfeld, 1823 Bergen Street, Brooklyn, New York.

WE have a few practical money-making inventions for sale or trade. Adam Fisher Mfg. Co., 183B, St. Louis, Missouri.

GAMES AND ENTERTAINMENT

FINEST feather flowers; magic apparatus; magic books; stage money; ventriloquist figures; secrets. Five catalogs 15c. Gilmagico, 11135 South Irving, Chicago.

CHALK TALK, Illustrated in colors. Fine rag pictures. Lecture for pictures. Price $1.00. R. H. Johnson, 4514 South 20th Street, Omaha, Nebraska.

TRICKS, Escapes, Puzzles Photos, Books. Catalogue free. Magicraft Co., Dept. E., Box 251, Detroit, Michigan.

MAGIC—Tricks, Jokes, Books, Pictures, Etc. Big catalog for stamp. United Sales Co., Springfield, Illinois.

TRICKS, Puzzles, Jokes, Plays, Wigs, Mind Reading Acts and Sensational Escapes. Send stamp for catalogue. Oaks Magical Company, Dept. 400, Oshkosh, Wisconsin.

GAMES, puzzles, magic tricks, books. Catalogue free. Pastime Circle, St. Louis, Missouri.

125 CARD Tricks, and how to do them. 25c. United Sales Co., Springfield, Illinois.

Quick-Action Advertisements continued on page 12

MONEY! MONEY!! MONEY!!!

The Shortest, Easiest and Surest Road to Prosperity and Success

A Subtle Principle of Success

A subtle principle in my hands, without education, without capital, without training, without experience, and without study or waste of time and without health, vitality or will power has given me the power to earn more than a million dollars without selling merchandise, stocks, bonds, books, drugs, appliances or any material thing of any character.

This subtle and basic principle of success requires no will power, no exercise, no strength, no energy, no study, no writing, no dieting, no concentration and no conscious deep breathing. There is nothing to practice, nothing to study, and nothing to sell

This Subtle Principle must not be confused with memory systems, "will power" systems, Christian Science, psychology, magnetism, thrift or economy, nor should it be confused with health systems, auto-suggestion, concentration, "personality," self-confidence or opportunity, nor should this Subtle Principle be confused with initiative, mental endurance, luck, chance, self-analysis or self-control. Neither should this principle be confused with imagination, enthusiasm, persuasion, force or persistence, nor with the art or science of talking or salesmanship, or advertising.

No one has yet succeeded in gaining success without it.

No one has ever succeeded in failing with it.

It is absolutely the master key to success, prosperity and supremacy.

When I was eighteen years of age it looked to me as though I had absolutely no chance to succeed. Fifteen months altogether in common public school was the extent of my education. I had no money. When my father died, he left me twenty dollars and fifty cents, and I was earning hardly enough to keep myself alive. I had no friends for I was negative and of no advantage to any one. I had no plan of life to help me solve my problem. In fact, I did not know enough to know that life is and was a real problem, even though I had an "acute problem of life" on my hands. I was blue and despondent and thoughts of eternal misery arose in my mind constantly. I was a living and walking worry machine.

I was tired, nervous, restless. I could not sleep. I could not digest without distress. I had no power of application. Nothing appealed to me. Nothing appeared worth doing from the fear that I could not do anything because of my poor equipment of mind and body. I felt that I was shut out of the world of success and I lived in a world of failure.

I was such a pauper in spirit that I blindly depended on drugs and doctors for my health as my father before me. I was a "floater" and depended on luck for success. The result of this attitude on my part was greater weakness, sickness, failure and misery as is always the case under similar condition.

Gradually my condition became worse. I reached a degree of misery that seemed intolerable. I reached a crisis in my realization of my failure and adverse condition.

Out of this misery and failure and pauperism of spirit—out of this distress—arose within me a desperate reaction—"a final effort to live"—and through this reaction, arose within me, the discovery of the laws and principles of life, evolution, personality, mind, health, success and supremacy. Also out of this misery arose within me the discovery of the inevitable laws and principles of failure and sickness and inferiority.

When I discovered that I had unconsciously been employing the principles of failure and sickness, I immediately began to use the principles of success and supremacy. My life underwent an almost immediate change. I overcame illness through health, weakness through power, inferior evolution by superior evolution, failure by success, and converted pauperism into supremacy.

I discovered a principle which I observed that all successful personalities employ, either consciously or unconsciously. I also discovered a principle of evolution and believed that if I used it, that my conditions would change, for I had but one disease—failure, and therefore there was but one cure—success, and I began to use this principle and out of its use arose my ambition, my powers, my education, my health, my success and my supremacy, etc., etc.

You may also use this principle of success deliberately, purposefully, consciously and profitably.

Just as there is a principle of darkness, there is also a principle of failure, ill-health, weakness and negativeness. If you use the principle of failure consciously or unconsciously, you are sure always to be a failure. Why seek success and supremacy through blindly seeking to find your path through the maze of difficulties? Why not open your "mental eyes" through the use of this subtle success principle, and thus deliberately and purposefully and consciously and successfully advance in the direction of supremacy and away from failure and adversity?

I discovered this subtle principle—this key to success—through misery and necessity. You need never be miserable to have the benefit of this subtle principle. You may use this success principle just as successful individuals of all time, of all countries, of all races, and of all religions have used it either consciously or unconsciously, and as I am using it consciously, purposefully. It requires no education, no preparation, no preliminary knowledge. Any one can use it. Any one can harness, employ and capitalize it, and thus put it to work for success and supremacy. Regardless of what kind of success you desire, this subtle principle is the key that opens the avenue to what you want.

It was used by

Moses,
Caesar,
Napoleon,
Roosevelt,
Rockefeller,
Herbert Spencer,
Emerson,
Darwin,
J. P. Morgan,
Harriman,
Woodrow Wilson,
Charles Schwab,
Lloyd-George,
Clemenceau,
Charles E. Hughes,
Abraham Lincoln,
George Washington,
Marshall Field,
Cleopatra,
Alexander the Great,
Edison,
Wanamaker,
Phil Armour,
Carnegie,
Frick,
Elbert Hubbard,
Hiram Johnson,
Shakespeare,
Mozart,
Mendlessohn,
Copernicus,
Confucius,
Mohammed,
Cicero,
Demosthenes,
Aristotle,
Plutarch,
Christopher Columbus,
Vanderbilt,
Marcus Aurelius,
Pericles,
Lycurgus,
Benjamin Franklin,

and thousands and thousands of others—the names of successful men and women of all times and of all countries and of all religions, and of all colors, make a record of the action of this Subtle Principle of success. None of these individuals could have succeeded without it—no one can succeed without it—no one can fail with it.

Every one realizes that human beings owe a duty to each other. Only the very lowest type of human beings is selfish to the degree of wishing to profit without helping some one else. This world does not contain very great numbers of the lowest and most selfish type of human beings. Almost every one, in discovering something of value, also wants his fellow man to profit through his discovery. This is precisely my attitude. I feel that I should be neglecting my most important duty toward my fellow human beings, if I did not make every effort—every decent and honest effort—to induce every one to also benefit to a maximum extent through the automatic use of this subtle principle.

I fully realize that it is human nature to have less confidence in this principle because I am putting it in the hands of thousands of individuals for only a few pennies—at less than the actual cost of mailing, writing, composing and advertising it—but I cannot help the negative impression I thus possibly create. I must fulfill my duty just the same.

I do not urge any one to procure it because I offer it for a few pennies, but because the results are great—very great.

This subtle principle is so absolutely powerful and overmastering in its influence for good, profit, prosperity and success, that it would be a sin if I kept it to myself and used it only for my personal benefit.

So sure am I of the truth of my statements—so absolutely positive am I of the correctness of my assumption and so absolutely certain am I that this principle, in your hands, will work wonders for you that I am willing to place this principle in your hands at my risk and expense. You will recognize the value of this principle within twenty-four hours—in fact, almost immediately as you become conscious of it, you will realize its practicability, its potency, its reality and its power and usability for your personal profit, pleasure, advancement, prosperity and success.

Thousands of individuals claim that the information disclosing and elucidating the secret principle of success is worth a thousand dollars of any one's money. Some have written that they would not take a million dollars for it.

You will wonder that I do not charge a thousand dollars for this information—for disclosing this principle, after you get it into your possession and realize its tremendous power and influence.

I have derived such tremendous results—amazing results from its power, that I want every man, woman and matured child to have this key to success, prosperity and wealth. This is why I am willing to send it to any one—to any address on approval without a single penny in advance.

You would never forgive me, and I could never forgive myself, nor could the creative forces of the Universe forgive us, if I failed to bring you to the point of using this subtle principle of success. **You would never forgive me** if I failed to do for you that which you would do for me, if our positions were reversed.

Write your address on the request below and mail it to me, and you will receive by return mail, the SUBTLE PRINCIPLE OF SUCCESS—the master principle—the key to your success and supremacy—the equal of which you have never seen.

If this subtle principle of success does not solve your every problem, it will cost you absolutely nothing.

ALOIS P. SWOBODA

771 Berkeley Bldg., West 44th St., New York City

ALOIS P. SWOBODA,
771 Berkeley Building,
West 44th Street, New York City.

You may send me the full explanation and elucidation of the **"SUBTLE PRINCIPLE OF SUCCESS"** and how to use it for my personal benefit and supremacy.

I promise to either re-mail it to you, within twenty-four hours of its receipt by me, or to send you Two Dollars.

It is understood that I am to be under no other obligation neither now nor later.

Name.....
(write plainly)

Address.....

City.....**State**.....

If this "SUBTLE PRINCIPLE OF SUCCESS" in your own hands is not worth at least a Thousand Dollars ($1,000.00)—it will cost you absolutely nothing.

NOTE:—The above statements in Popular Science Monthly are guaranteed in every way to be as represented.

PHOTOGRAPHY AND SUPPLIES

MAIL us 20c with any size film for development and six velvet prints. Or send six negatives any size and 20c for six prints. Or send 40c for one 8x10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Company, 212 Bell Avenue, Roanoke, Virginia.

FILMS developed 5c roll, prints 3c each. Photo Service, 929 McMillan, Cincinnati, Ohio.

DISABLED Soldiers Photo Company, 3654 North Halsted Street, Chicago. Films developed 7c. Trial prints 3c. Post cards, 5c. Work guaranteed.

MR. ADVERTISER: Ask to-day for a copy of the "Quick Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

OHIO man sends five orders inside twenty days: 78 prints, remits $4.50. Crazy? No! "Dee-lighted." Cause: Polished silvertone prints. Try 'em! Six for 20c silver. Send roll or negatives, developing always free. "Silvertone," 950 B. Lockwood, Chicago.

SPECIAL offer—Your next kodak film developed 10c., and first six prints 2c. each. 24 hours service. Enclose money with order. Write for price list "3" and sample print. Johnston & Tunick, 53 Nassau Street, New York.

PHOTOGRAPHERS—Mallinckrodt's pure Hydrochinone, $2.65 pound, prepaid. Grant Myers, Summit, New Jersey.

SAMPLE enlargement, dime and negative (returned). Roll developed and six prints, 25c. silver. Brown Studio, Lake Elmo, Minnesota.

MUSIC AND SHEET MUSIC

SAXOPHONISTS. Wonderful correspondence course ready. Write Virtuoso School, Buffalo, New York.

WRITE the words for a song. We write music, guarantee publisher's acceptance. Submit poems on patriotism, love or any subject. Chester Music Company, 920 South Michigan Avenue, Room 111, Chicago.

WRITE the words for a song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 121C Fitzgerald Building, New York.

HAVE you song poems? I have best proposition. Ray Hibbeler, D1, 4040 Dickens Avenue, Chicago, Illinois.

YOU Write the Words for a Song—We'll compose the music free and publish same. Send Song Poem today. A. G. Lenox Co., 271 West 125th Street, New York.

CORNETISTS—Trombonists send for "Free Pointers." Weak lips. High tones. Virtuoso School, Buffalo, New York.

WRITE a Song Poem—Love, Mother, Home, Comic or any subject. I compose music and guarantee publication. Send words today. Edward Trent, 631 Reaper Block, Chicago.

MUSICAL INSTRUMENTS

HAWAIIAN-made ukuleles and steel guitars. Agents wanted. Men or women. Kamaka Ukulele Company, Honolulu, Hawaii.

VIOLINS—Deep, Mellow, Soulful—on credit. Easy terms for wonderful instrument. Get details today. Gustav L. Henning, 2424 Gaylord Street, Denver, Colorado.

PHONOGRAPHS, RECORDS, NEEDLES

BUILD your own phonograph. Big saving. Pleasant, instructive work. Complete instructions, blue-prints, etc., absolutely free. Write to-day, Associated Phonograph Company, Dept. F1, Cincinnati, Ohio.

BUILD your Phonograph. "Perfection" high quality spring and electric Motors. Tone Arms. Reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Indiana.

BUILD better phonographs. Belltona Quality Phono Parts make the best phonographs. Catalogue free. Belltona Company, North Tonawanda, New York.

BUILD a genuine Choraleon Phonograph and save over half. Fine profits building and selling. We furnish motors, tone arms and necessary parts. Send for our catalog and Free blue print offer. Choraleon Phonograph Company, 1123 Monger Building, Elkhart, Indiana.

MOTION PICTURE BUSINESS

YOUR opportunity to enter a Big Money making business. Small investment buys standard, professional moving picture machine, film, full line of supplies, complete stationary or traveling equipments all ready for work. Easy payments. Your choice of three lighting systems. Openings everywhere. We teach you the business. Large Catalog FREE. Monarch Theatre Supply Co., Dept. 535, Ellsworth Building, Chicago, Illinois.

WRITE Photoplays; $50 each. Experience unnecessary; details free to beginners. Producers' League, 194, St. Louis.

PHOTOPLAYS Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, F 30, Chicago.

FREE Booklet containing 65 helpful suggestions on writing and selling photoplays, stories, poems, songs. Atlas Publishing Co., 312 Cincinnati, Ohio.

WRITE PHOTOPLAYS. $50 paid for suitable ideas. Details free. Seneca Studio, Dept. B., 166 East Perry Street, Tiffin, Ohio.

$35.00 PROFIT nightly. Small capital starts you. No experience needed. Our machines are used and endorsed by government institutions. Catalog Free. Atlas Moving Picture Co., 455 Morton Bldg., Chicago.

AUTHORS—MANUSCRIPTS

WRITE for newspapers and magazines. Big Pay. Experience unnecessary, details free. Press Reporting Syndicate, 400, St. Louis.

WRITERS: Have you a song-poem, story, photoplay, to sell? Submit manuscript now to Music Sales Company, 48, St. Louis.

WRITERS: Stories, poems, plays, etc., are wanted for publication. Literary Bureau, 117, Hannibal, Missouri.

IDEA Exchange, magazine especially for amateur inventors and authors. Year, $1.00. Copy, 10c. Brookings, South Dakota.

REAL ESTATE—FARM LANDS

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Quick-Action Advertisements continued on page 14

An Amazingly Easy Way to Earn $10,000 a Year

Let Me Show You How Free

TO the average man the $10,000 a year job is only a dream. Yet today there are a surprising number of men earning five figure salaries who were merely dreaming of them a short while ago. The secret of their success should prove a startling revelation to every ambitious man who has ever aspired to get into the $10,000 a year class.

There is nothing fundamentally "different" about the man whose salary runs into five figures. He is made of the same stuff as you and I. It is not necessary that he must enjoy the privilege of some influential connection or "pull." For example take J. P. Overstreet, of Dallas, Texas. A few short years ago he was a police officer earning less than $1,000 a year. To-day his earnings are in excess of $1,000 a month—more than $12,000 a year. C. W. Campbell, Greensburg, Pa., was formerly a railroad employee on a small salary—last month his earnings were $1,562.

Why Salesmen Earn Such Big Pay

Just stop a moment and think over the successful men of your acquaintance. How many of them are connected with some form of selling? If you will study any business organization you will see that the big jobs go to the men who sell, for upon their efforts depend the profits a company makes. Without trained men to place a product on the market, the finest goods are worth no more than so much clay. Salesmen are the very nerve centers of a business. Is it any wonder that they earn big pay?

The man who starts working as a bookkeeper or clerk for $25.00 a week, never increases his value to the firm. Any advance in pay is merely a reward for length of service. At the end of ten years he is no more essential to the life of the organization than he was at the end of ten weeks. He is only a necessary liability—drawing his pay because somebody must be found to work at the unimportant, routine jobs. Once established in the rut, he becomes a cog in the machine—when he is worn out, he can be easily and cheaply replaced.

Why Don't You Get Into the Selling Field?

Mr. Overstreet, Mr. Campbell and the others whose letters you see on this page are all successful salesmen. They realized their ambitions by landing $10,000 jobs in an amazingly simple way, with the help and guidance of the National Salesmen's Training Association. Sometime—somewhere back in the past, each one of them read of this remarkable course of Salesmanship training and Employment Service just as you are reading of it to-day. Each one of them was dissatisfied with his earning capacity—as perhaps you are—and each one cast his lot with the N. S. T. A. To-day they are important factors in the business world—enjoying all the comforts and luxuries money can buy. And yet they are not exceptions, for there are thousands of N. S. T. A. trained salesmen who are making big money, as we will be only too glad to show you if you will mail the coupon.

We Train You and Help You Land a Job

The National Salesmen's Training Association is an organization of top-notch salesmen and sales managers formed for the express purpose of training men in the science of successful selling. You do not need to know the first thing about selling—for the N. S. T. A. trains you from the ground up—gives you a complete insight into selling methods—in your spare time without making it necessary to give up your present position until you are ready to begin actual selling.

In addition to this remarkably efficient course of training, the N. S. T. A. maintains a Free Employment Service to help its Members to jobs in the lines for which they are best suited. This in itself is of incalculable value for it allows the prospective salesman to make a complete survey of the selling field and to select the work which most appeals to him.

Read These Amazing Stories of Quick Success

Earned $524 in Two Weeks

I had never earned more than $60 a month. Last week I cleared $306 and this week $218. You have done wonders for me.—Geo. W. Kearns, 107 W. Park Place, Oklahoma City, Okla.

I Now Earn as High as $100 a Day

I took your course two years ago. Was earning $15 a week clerking. Am now selling many of the largest firms in the U. S. I have earned more than $100 in a day. You secured me my position. Our Sales Manager is a graduate of yours.—J. L. DeBonis, 1628 S. Crawford Ave., Chicago, Ill.

Earns $1,562 in Thirty Days

My earnings for the past thirty days are $1,562, and I won Second Prize in March although I only worked two weeks during that month.—C. W. Campbell, Greensburg, Pa.

Earned $1,800 in Six Weeks

As soon as I received a letter from you and your literature, I knew that I was on the right track and very soon after I applied for a position as a Salesman to one of the firms whom you informed me were in need of a Salesman and to whom you had recommended me. As soon as they received my application, which was by mail, they wired me to come for an appointment which I did, with the result being that I sold my services to them in about thirty minutes, took a territory in Illinois and Wisconsin and made a success of it from the very first week.

From that time on I have been what might be termed as a "high pressure" Salesman, selling lines where nine out of ten Order Takers would fail. I have sold goods in a highly successful manner in nine or ten States, both North and South. My earnings for March were over $1,000 and over $1,800 for the last six weeks, while last week my earnings were $356.00. I travel eleven months out of the year, working five days each week.

The N. S. T. A. dug me out of a rut where I was earning less than $1,000 a year and showed me how to make a success.—J. P. Overstreet, Dallas, Texas.

Salesmen Are Needed—Now!

Get out of that rut! Work for yourself! Salesmanship is the biggest paid of all professions. Just because you have never sold anything is no sign that you can't. We have made Star Salesmen of men from all walks of life, with no previous selling experience. These men have jumped from small pay jobs to big selling positions and handsome incomes. The same training on which they founded their success is open to you. You can follow in their footsteps. Why don't you get in a class with men who make real money? Never before have the opportunities been greater. At least you cannot afford *not* to investigate the great field of Selling and see what it offers *you*. It will only cost you a 2 cent stamp and the facts and proof you will receive will surprise you.

Free Book on Salesmanship

Just mail the coupon or write for our free illustrated Book, "A Knight of the Grip," which we will be glad to send without any obligation on your part. Let us prove to you that regardless of what you are doing now, you can quickly become a Star Salesman. Let us show you how you too can step into the ranks of these big money makers of business. See how easily you can learn this fascinating, big pay profession at home in your spare time. Learn what we have done for others and what we stand ready to do for you. Don't put it off until to-morrow—write us to-day. Every hour lost keeps you that much farther from success. Mail the coupon at once.

National Salesmen's Training Association
Dept. 15-S, Chicago, Ill., U. S. A.

National Salesmen's Training Association
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Please send me, without any obligation on my part, your free Book, "A Knight of the Grip," and full information about the N. S. T. A. system of Salesmanship training and Employment Service. Also a list showing lines of business with openings for salesmen.

Name.....

Street.....

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TAILORING Agents Wanted—Big complete sample outfit and case, nearly 200 large cloth samples, 3-price lists and everything needed for canvassing, or use in store, free to live agents. $25.00 to $50.00 a week; may make more. Write us to-day for free elegant outfit to begin, cloth samples, wholesale prices, special offer on a suit for yourself and full information. See our wonderful value, beautiful fabrics and styles. Established 28 years. Every garment made to measure—everything guaranteed and express prepaid. Just send a postal. American Woolen Mills Company, Dept. 1407, Chicago.

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SELL latest joke novelties. Stamp brings particulars. Mears, 66 Anderson, Indiana.

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REPRESENTATIVE Wanted to handle our complete line of fire protection devices, such as Ajax chemical fire engines on wheels, hand fire extinguishers, fire buckets and tanks, hose carts, racks, reels and hose, watchmen's clocks, ladders, escapes, signs, etc. Every factory, mill, store, fire department, etc., is in the market for our extensive line. Representatives wanted capable of earning $5000 upwards, annually. Ajax Fire Engine Works, Bush Terminal Building, Brooklyn, New York.

AGENTS wanted to sell our 25 light acetylene gas generator; fully guaranteed; cheap; safe and reliable. Write Daniel Zimmerman, Magley, Indiana.

$10 WORTH of finest toilet soaps, perfumes, toilet waters, spices, etc., absolutely free to agents on our refund plan. Lacassian Co., Dept. 615, St. Louis, Missouri.

AGENTS wanted for automobile specialties, three big sellers, patented, big profit, no competition, every owner a prospect. Rubber Steering Grips, Lubricators, Lamp Brackets and others. Fracto Specialty Co., Manufacturers, 161 Massachusetts Avenue, Boston, Massachusetts.

ONE sale a day means $200 per month. Five a day—$1,000 per month. Marvelous new Automatic Adding Machine, retails $12.50. Work equals $300 machine. Five-year guarantee. Write quick for protected territory and trial offer. Calculator Corporation, Dept. O, Grand Rapids, Michigan.

SELL "Victorclean" Washing Wonder. It's a wonderful repeater. Free samples to boost sales. Skytt, 725 East 5th, Duluth, Minnesota.

EASY, pleasant work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Company, 27 Bar Street, Canton, Ohio.

AGENTS—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

AGENTS, big profits selling famous Keen-O Polish and Rug Cleaner. Something new, samples and particulars 35c. Keen-O Polish Company, 1605 Prairie Avenue, Kenosha, Wisconsin.

SIGNS for stores and offices. Entirely new. $50 week easily made. Chicago Sign System. T-326 River Street, Chicago.

"FLOWER Bead Necklaces" fast sellers, want agents every state. Wood Bead Company, 230 East 30th Street, Los Angeles.

AGENTS: Sell our accident and sickness policies in your spare time. Pay $5000 death, $25 weekly benefit. Premium $10 yearly. Permanent income from renewals. Easy seller. Liberal commissions. Insurance Company, Dept. J-4, Newark, New Jersey.

AGENTS wanted to sell the famous "Flexedge" engine valves that are guaranteed not to pit, warp, leak, crack or need regrinding. Automobile owners buy them readily because they are a good financial investment. They are used as regular equipment by prominent manufacturers of automobiles and by builders of oil burning engines. An attractive proposition awaits your request. S. S. V. Co., 706 Townsend Street, Chicago.

MAKE big money manufacturing marble, onyx, agate, tile, more beautiful than genuine at cost of about 10c sq. ft. Marble face brick any color, $15.00 thousand—sell $75.00. Experience unnecessary. Money back guaranteed with all expenses incurred if you cannot make products listed by following my instructions. Send for sample and list. B. F. Spencer. Box 213, Los Angeles, California.

AGENTS! Side-line men! Lite-o-Rite is the fastest selling novelty ever produced. Perfect combination pocket pencil and cigar lighter. Sells to cigar, drug, stationery, novelty, premium, punch board trade, etc. Send $5.40 for sample dozen. Money back guarantee. The Art Metal Works, Dept. S., Newark, New Jersey.

WATER STILLS, made entirely of heavy copper, one or four gallon capacity. Prices $30.00 and $50.00 respectively. Shipped prepaid by express or parcel post the same day we receive your order. Ideal for distilling water for automobile batteries, industrial uses and drinking purposes. References: U. S. National Bank, or Bradstreets, Omaha, Boyer & Co., PS 519 Farnham Building, Omaha, Nebraska.

NEWSOM vavles double tire mileage. Snap Lox dust caps add snap to any car. Motorists buy on sight. Pocket samples. Territory going fast. Get yours now. R. T. Sales Company, 3847 Madison Street, Chicago, Illinois.

$1,000 per Man per County: Strange invention startles world—agents amazed. Ten inexperienced men divide $40,000. Krostad, a farmer, did $2,200 in 14 days. Sleicher, a minister, $195 first 12 hours. $1,200 cold cash, made, paid, banked by Stoneman, in 30 days: $15,000 to date. A hot or cold running water bath, equipped for any home at only $7.50. Self-heating. No plumbing or water-works required. Investigate. Exclusive sale. Credit given. Send no money. Write letter or postal to-day. Allen Mfg. Co., 572 Allen Building, Toledo, Ohio.

SPIRIT hydrometers, testing distilled liquids. 1 to 200 proof, $2.50 prepaid. Agents, commission. Golden, Box 1682, Pittsburgh, Pennsylvania.

SELL necessities. Everybody needs and buys the "Business Guide." Bryant cleared $800 in July. Send for sample. It's free. Nichols Company, Box 1B, Naperville, Illinois.

MONEY in auto specialty. Agents wanted for tried and tested Century Process for preserving paint on autos. Big money—easy work. Particulars free. Century Products Company, Dept. F-3, Cincinnati, Ohio.

GET our plan for selling Arion Phonographs at home. No canvassing. Quality equal to high priced instruments sold in stores. Low price gets you the business—quality builds more business for you. Big profits. Write today. Arion Phonograph Company, 1112 Arion Building, Elkhart, Indiana.

EASY Oilers for Ford Engines make "Easy Money" for Dealers and Agents. Sample $1. Write for agency. Magee & Company, Woodward Building, Washington, D. C.

DISTRICT Managers to sell three high class phonographs direct to farmers and dealers. Guaranteed saving fifty dollars on every phonograph. If you qualify with bank references on your financial standing and character I will finance you; furnish you samples; help you get into Ten Thousand Dollar year class. Nat Kawin, Great Eastern Manufacturers Company, 316 South Wabash Avenue, Chicago.

WOULD year round quick seller interest you? Dept. 10, Martinek Co., 405 Lexington Avenue, New York.

I WANT 100 men and women quick to take orders for Comer raincoats and waterproof aprons. Everybody buys. McCrary's profits last year were $5,218. New styles—wonderful bargains—direct from manufacturer to wearer. Barnes made $523 in thirty days. Tremendous profits for you. $2,500 a year for three average orders a day. $10 a day for your spare time. No delivering nor collecting. No capital required. I furnish everything, including beautiful sample coat. Write quick for liberal offer. The Comer Mfg. Co., Dept. 0-41, Dayton, Ohio.

DOUBLE your income every week. Nature does it while you sleep. Self addressed envelope for report. V. B. Company, Pearl River, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

Quick-Action Advertisements continued on page 16

Start a Garage of Your Own. Thousands Needed. Good Territory Open

Dozens of M. S. A. S. Graduates Are Making from $5,000 to $10,000 a Year in the Garage Business

MAKE $500 A MONTH AND MORE

Have a Business of Your Own

IF you have any ambition to get out of the rut and have a **business of your own,** there never was a better opportunity than there is NOW in the Automobile and Tractor business. There are thousands of excellent openings in good territory for garages, repair shops, and service stations. Millions of automobile, truck and tractor users are greatly handicapped for lack of garages and shops that do dependable work.

Hundreds of our graduates (many of whom knew nothing of automobiles or tractors before training) are now making $5,000 to $10,000 a year. Many of these men had little or no capital.

HERE ARE A FEW EXAMPLES FROM OUR THOUSANDS OF SUCCESSFUL GRADUATES

J. S. Steckel, of Coplay, Ill., was a loom fixer at $18.00 a week. He trained at the M. S. A. S. and now he has a garage of his own paying a profit of over $100 a week.

W. F. Harms of Eldridge, Iowa, was a farm hand at $35.00 a month. Today, after training at M. S. A. S. he has a garage business and three helpers; profits are $500 a month.

Before training, Byron Hulton at Floyd, Va., was working for $40 a month. Now he has a half interest in a garage business that pays a profit of over $1000 a month.

Before training at M. S. A. S., H. A. Bradley of Cleveland, was a shipping clerk at $12.00 a week. Now he has a business of his own in Cleveland, monthly profits over $500 a month.

Tony Dandres, Austin, Pa., was a common laborer. Now he has a garage with more business than he can handle with three men.

C. F. Swabson of Sioux City, Ia., was working by the day. Now his pronts run $520 a month in garage and car sales.

Marten Vander Bie and F. E. Dulyes of Holland, Mich., M.S.A.S. graduates, have one of the best garages in Western Michigan.

FACTS YOU CAN'T AFFORD TO OVERLOOK

In choosing an automobile and tractor school, there is one thing above all others to bear in mind, that is, this—you cannot learn the automobile and tractor business **properly** in six to eight weeks. The leading manufacturers, all of whom assisted in outlining our courses, recommend 10 to 12 weeks, or more.

The Manufacturers Know Their Business Our Course Is Given As Specified By Them

That's why our graduates succeed, are constantly in demand and are given preference. Nowhere else can this **factory outlined** and factory endorsed course be found.

M. S. A. S. TRAINING covers every point of knowledge and practice required of a successful automotive expert. We teach automobiles and tractors from A to Z. Very thorough and complete training in electrics. Actual experience in assembling, block testing, bearing scraping, repairing, including batteries. Tractor training, with actual field practice on M. S. A. S. tractor farm, included in complete Auto Course. Our equipment and training are positively the best.

Brazing and welding and tire-repairing are also taught.

The M. S. A. S. can teach you how to conduct a business of your own successfully. How to repair and sell cars, how to judge used car values and give you the necessary pointers in garage management, equipment, etc. Graduates are life members with all service advantages free. You can return any time and "brush up" on new equipment free of charge.

Think what this will mean to you.

DETROIT IS THE PLACE TO TRAIN. 94% of automobiles are made within a radius of 100 miles around Detroit. 71% right in the city. The greatest automotive experts in the world are here, and they helped to outline our course for you. **LEADING MANUFACTURERS ENDORSE AND RECOMMEND OUR SCHOOL.** They have placed their machines with us for the instruction of students. They are constantly sending us students and calling for graduates. There is no training equal to M. S. A. S.

M. S. A. S. Training is a "real thing,"—and a real opportunity awaits you. Find out more about it.

Write for big free 124-page catalog and auto school monthly news. They give full particulars.

SEND THIS COUPON NOW

MICHIGAN STATE AUTO SCHOOL
591 Auto Bldg. 687-91 Woodward Ave.
Detroit, Mich., U. S. A.

Gentlemen:—Please send me, absolutely FREE, Big, Illustrated Catalog, "Auto School News," and information as checked below.

( ) Auto and Tractor Course ( ) Tire Repairing
( ) Brazing and Welding

Mark each course you are interested in
Or better still, you may expect me about.....

Name .....

Street .....

.....State..... .....

DETROIT
THE HEART OF THE AUTO INDUSTRY
44 AUTOMOBILE FACTORIES — THE AUTOMOBILE CENTER OF THE WORLD — 140 ACCESSORY FACTORIES

MICHIGAN STATE AUTO SCHOOL

"Most Progressive Auto School in America"—"In the Heart of the Auto Industry"

591 Auto Building
687-89-91 Woodward Ave. **Detroit, Mich., U.S.A.**

DETROIT
THE HEART OF THE AUTO INDUSTRY
44 AUTOMOBILE FACTORIES — THE AUTOMOBILE CENTER OF THE WORLD — 140 ACCESSORY FACTORIES

MEN, get into the wonderful tailoring agency business, big profits taking orders and your own clothes free. We furnish fine sample outfit and everything free. No experience needed. Write today. Banner Tailoring Co., Dept. 754, Chicago.

DOLLAR specialty. Costs 25c. Universally needed. Many buy hundreds. Make $15 daily. 202 Pennsylvania Building, Philadelphia.

SALESMEN—$10-$30 daily—Peanut, Gum, Candy Machine Combinations—Trade Boosters also Salesboards. Cash Commissions $2.50-$20.00 each sale and all reorders from customers. Burton, 3620 Cottage Grove, Chicago.

WORLD'S fastest selling auto accessory! County distributors wanted; write today. G. L. W. Spring Oiler Co., San Diego, California.

"KLEAN-RITE" washes clothes without rubbing; Whirlwind seller. 350% profit. Samples free. "Besco," 3253-P, Belleplaine, Chicago.

WOULD year round quick-seller interest you? Dept. 10, Martinek Company, 405 Lexington Avenue, New York.

AGENTS—Seventy dollars weekly taking subscriptions. Particulars. Thompson, 101 St. Marks Avenue, Brooklyn, New York.

LUMINOUS PAINT—Makes any article visible in the dark. Bottle, 50c. Guaranteed. Sample, particulars for "Red" stamp. Illuminant Company, 744JP North Lockwood, Chicago.

WATER STILLS, made of heavy copper; one gallon capacity, $25; four gallon, $40. Suitable for distillation of all liquids. N. J. Richard & Company, C1416 Broadway, New York City.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

STOCK in pocket, $10.00 profit. No risk! Don't have to buy. Sample, Quarter. Try it. You ought to! Returned if you don't wish to try. V. B. Company, Pearl River, New York.

WATER STILLS, made of heavy copper; two gallon capacity, $25, four gallon, $40. Suitable for distillation of all liquids. Directions given. N. J. Richard & Company, 200 Broadway, C310, New York City.

BIG money varnishing floors, woodwork, etc., $1.00 brings you directions for making brilliant oil varnish at $.75 per gallon. C. Parker, Box 1234, Seattle, Washington.

PORTRAIT AGENTS—who want good work and prompt service and who desire to purchase their frames at factory prices should write us at once for catalog and price list. W. G. Hannan Co., Dept. A-15, 57 East 18th Street, Chicago, Illinois.

WERE You Ever Offered A Grocery Store? You can handle Sugar, Flour, Canned Goods, Dried Fruit, Coffee and entire line of Groceries, as well as Paints, Roofing, Aluminum Ware and Automobile Oils, with no rent to pay; no money invested; take large orders from samples. Goods are guaranteed and proven quality. Selling experience not necessary. Steady, profitable work for "workers." Address Hitchcock-Hill Company, Dept. 220, Chicago, Illinois. Reference: Any Bank or Express Company.

HOW to mix 50 different colors; chart dollar, postpaid. Dept. 61, Martinek Paint Co., 405 Lexington Avenue, New York.

$75.00 WEEKLY.—Guaranteed only razor you cannot cut yourself. Big demand. Wonderful seller for $1.00. Standard Safety Razor Corporation, Pittsburgh, Pennsylvania.

AGENTS—Snappiest Household Line on earth. Red hot sellers, steady repeaters—100% profit. 350 light weight, fast selling, popular priced necessities. Agents outfit free. Get busy—quick. Write today; postal will do. American Products Co., 2356 American Building, Cincinnati, Ohio.

MAKE $50 Daily—Something New—400% Profit. Free Sample. Business, Professional Men re-order weekly. Retails $5.00. Your Profit $4.00. Write for State Rights quickly. Headquarters, Drawer 596, Hartford, Connecticut.

AGENTS: We guarantee to pay $12 a day taking orders for 2 in 1 Reversible Raincoat. One side handsome Raincoat, reverse side fine dress coat. Something new. Latest style. Guaranteed waterproof. No capital required. You take orders. We ship by Parcel Post, and do all collecting. Commission paid same day your orders booked. Write quick. Thomas Mfg. Co., Class 1361, Dayton, Ohio.

AGENTS make big money because sales may be made in every home. Our modern aids to home sanitation have an appeal that cannot be resisted. A brush, mop or duster for every need. Liberal commissions and good territory. North Ridge Brush Company, 136 Clark Street, Freeport, Illinois.

MAKE $30.00 next Saturday. Speederator for Fords selling like wildfire. Used by Ford Motor officials. Makes any Ford run like a Packard. Stops stalling and bucking. Put on quick—instant satisfaction. No holes to bore. Sell ten to twelve a day easy. Splendid profits and exclusive territory. Write quick for information. Address Perrin Company, 1072 Hayward Building, Detroit, Michigan.

SALESMEN—Side or main line, to sell low-priced 6,000 mile guaranteed automobile tires, 30x3½ non-skid sells for $13.95; other sizes in proportion. Good money-making proposition for live wires. Master Tire Co., 1414 South Michigan, Chicago.

HELP WANTED

BE a Finger Print Expert—$25 to $50 a week and more in this new and fascinating profession. Finger Print Experts hold positions of independence and trust. Work intensely interesting. They are in big demand by banks, corporations, big factories, detective agencies, etc. You can qualify. Write today for special limited offer and free illustrated Book. Tells all about Finger Prints. University of Applied Science, Room 1868, 1920 Sunnyside Avenue, Chicago, Illinois.

DETECTIVES earn big money. Great demand. Travel. Experience unnecessary. We train you. Particulars free. Write, American Detective System, 1968 Broadway, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Missouri.

STOP daily grind. Start silvering mirrors. Auto headlights, tableware. Plans free. Clarence Sprinkle, Dept. 95, Marion, Indiana.

GET on the Stage. I tell you how! Send stamp for instructive Stage Book and particulars. A. La Delle, Box 557, Los Angeles, California.

BE a Mirror Expert, $3-$10 a day; spare time home at first; no capital; we train, start you making and silvering mirrors, French method. Free prospectus. W. F. Derr, Pres., 579 Decatur Street, Brooklyn, N. Y.

FIREMEN, Brakemen, Baggagemen, $140-$200, Colored Porters, by railroads everywhere. Experience unnecessary, 830 Railway Bureau, East St. Louis, Illinois.

MEN—Age 17 to 45. Experience unnecessary. Travel, make secret investigations, reports. Salaries, expenses. American Foreign Detective Agency, 321, St. Louis.

SILVERING mirrors, French plate taught. Easy to learn, immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Missouri.

RAILWAY traffic inspectors earn from $110 to $200 per month and expenses. Travel if desired. Unlimited advancement. No age limit. We train you. Positions furnished under guarantee. Write for Booklet CM-13, Standard Business Training Institute, Buffalo, New York.

PATENTS—Book free. Send sketch for free opinion of patentable nature. Talbert & Talbert, 4846 Talbert Building, Washington, D. C.

BE an Expert Penman. Wonderful new device guides your hand, corrects your writing in few days. Complete outline Free. Write Mr. Ozment, 52, St. Louis, Missouri.

MEN wanted for detective work. Experience unnecessary. Write J. Ganor, former Government Detective, 115 Danville, Illinois.

LEARN navigation by mail. Hundreds of ship officers needed by merchant marine. Salaries to $412 per month, expenses. Free illustrated booklet. World Technical Institute, Dept. G, Fuller Building, Jersey City, New Jersey.

WRITE Photoplays; $50 each. Experience unnecessary; details free to beginners. Producers' League, 194, St. Louis.

BIG demand for graduate electrical experts. Prepare quickly under Electrical Engineer. Thorough Home Study Methods. Small Expense. Albert Wood Wicks, E. E., Dept. 1777, 431 South Dearborn Street, Chicago.

BE A DETECTIVE—Big Pay; nice work; write Wagner, 186 East 79th, New York, Dept. 225.

MEN, get into the wonderful tailoring agency business, big profits taking orders and your own clothes free. We furnish fine sample outfit and everything free. No experience needed. Write today. Banner Tailoring Co., Dept. 755, Chicago.

BUSINESS OPPORTUNITIES

START A Lucrative Business Of Your Own. We teach you how to establish and operate a successful collection business, and refer items to you. No capital necessary. Practically no competition. Walter Sanford, Nashville, reports $34,523.43 gross earnings last year. Jos. P. Cullen, Washington, sends sworn statement showing gross earnings of $8,039.07 for March. O. H. Overholser, Dayton, says: "I averaged over $360 net commissions monthly last year and January shows $581.51 net. Such earnings bought my home and farm." Start now in spare time. You can succeed where 4,300 others have. Write today. Ask for "Pointers," and new plan. American Collection Service, 787 State Street, Detroit, Michigan.

100 FINEST quality cards, beautifully printed, and leatherette case stamped in gold, 85 cents postpaid. Write plainly. Raymond Card Company, 410 Superior Building, Cleveland, Ohio.

SUBSTANTIAL manufacturing corporation wants capable men to establish branch and manage salesmen. $300 to $2000 necessary. Will allow expenses to Baltimore as explained. Address Mr. Clemmer, 603 N. Eutaw St., Baltimore, Md.

ESTABLISH a business of your own. Take applications for our wonderful new accident and sickness policies costing from $5 to $20 annually and providing up to $7500 death benefit and $25.00 weekly income for disability. Men and women, any occupation, 16 to 65 years eligible. Wallet, bill-fold, identification certificate and registered metal key tag go with each policy. Exclusive and profitable territory open in every state. $1,000,000.00 Assets, in successful business since 1886. Liberal commission contracts, with same interest in renewals from year to year, to men or women who can get results. Experience unnecessary. North American Company, 308 Walnut Street, Philadelphia, Pennsylvania.

PATENTS Procured—Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C., or 2276-Z Woolworth Building, New York.

EXPERT Chemist will furnish Formula and Trade Secrets in all lines. Lists free. W. L. Cummings, Ph.D., Gordon Avenue, Syracuse, New York.

VULCANIZING Auto Tires growing and profitable business, especially now. Easy to learn. Instruction Book $1. Plants $50 up. Catalogue free. Equipment Company, 151 Canal Street, Cincinnati, Ohio.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Mo.

DOLLARS yearly in your backyard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. C. Metz, 313 East 89th St., New York.

INSYDE tyres, inner armor for automobile tires double mileage and prevent punctures and blowouts. Quickly applied. Cost little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 97B, Cincinnati, Ohio.

MAN or Woman, start anywhere; materials that cost equipment. Call or write for literature. Anderson Steam Vulcanizer Company, 2302 Grand Avenue, Kansas City, Missouri.

NEW discoveries; will increase your income $50-$100 weekly. No mail order or canvassing proposition. Send 4c stamp immediately for valuable pamphlet. Ferber Company, 296 Broadway, New York.

MR. BUSINESS MAN—would you like to be represented, and have the right to use a Newark Office address on your stationery and printed matter? I will represent any legitimate business for $2.50 a month or $20.00 a year. Send references with order to M. Ellis, 110 Riverside Avenue, Newark, New Jersey.

USED Correspondent Courses of all kinds sold. (Courses bought.) Lee Mountain, Pisgah, Alabama.

ADVERTISE—28 words in 250 weeklies, $10. Cope Agency, St. Louis.

FOR sale—old established mail order manufacturing business. For particulars address Pioneer Aquarium, Racine, Wisconsin.

START a magazine! capital $1; sample 10c. Cope Printery, St. Louis.

INVENTORS—My clients know every step taken in prosecuting their applications. Booklet sent free on request. Warner Cubberley, 20 National Union Bldg., Washington, D. C.

NEW Goods, Mail Order and Agents. Samples 15c; Catalog 2c. Harvey Teeple, Decatur, Indiana.

ART leaded stained glass window work, beautiful effects produced for homes, churches, signwork, etc. Complete instructions with necessary material, illustrated particulars free. Ed. Mahler (Box 5), Woodhaven, New York.

I MADE $30 a week evenings with a small mail-order business. Free Booklet tells how. 2c postage. Al Scott, Cohoes, New York.

PATENTS for sale. To sell, buy or obtain patents address Patent News—34, Washington, D. C.

FORTUNES made every year raising silver foxes. Easy to raise. Will not interfere with your regular employment. Booklet free. C. T. Dryz, Box 1013, Eagle River, Wisconsin.

ENTER a new business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty; openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy, job hunting, soliciting or agency. Address Stephenson Laboratory, 15 Back Bay, Boston, Massachusetts.

WE start you in business, furnishing everything. Men and women, $30.00 to $100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime. Booklet free. H. Ragsdale Company, East Orange, New Jersey.

GENERAL Manager Wanted, $3,000 to $10,000 a year income for one man every city; must open office or take desk room, appoint agents and introduce "FIREX"; sale every home, office, store, auto, factory, garage, public building, etc. Sales campaign free to those qualified. Few dollars capital makes big, quick money. Fire Company, Portland, Oregon.

BUY and exploit practical inventions. Trade for property. Form companies. Sell county rights. Adam Fisher Mfg. Co., 183D, St. Louis, Missouri.

$2.00 for 2100 mail order buyers, farmers, property owners, compiled from our private inquiries, orders, records July, 1920. Exceptional opportunity for all interested. Dept. 36, Martinek Paint Company, 405 Lexington Avenue, New York.

SALESMANSHIP! Increase your earnings. Wonder book! $2.00, Beehive, RE-2, 4337 North Lowell, Chicago.

WILL sell cheap a few $1,000 Rock Island Railroad Bonds (defaulted); only a few more left; write today. Bonds, Box 1055-A, Millville, New Jersey.

MEN, get into the wonderful tailoring agency business, big profits taking orders and your own clothes free. We furnish fine sample outfit and everything free. No experience needed. Write today. Banner Tailoring Co., Dept. 756, Chicago.

PATENTS—Book free. Send sketch for free opinion of patentable nature. Talbert & Talbert, 4847 Talbert Building, Washington, D. C.

AMBITIOUS? We establish you in business; manufacture article wanted everywhere, under your name, for 35c (retailing $1.50); furnish everything necessary to reach consumers, dealers, jobbers, agents, personally and by mail; and advertise for you free. Tremendous business. Kaley made $1,000 one month. Write for proof. Scientific Laboratories, 289 Court Street, Brooklyn, New York.

HOW to mix 50 different colors; chart dollar postpaid. Dept. 61, Martinek Paint Company, 405 Lexington Avenue, New York.

PLUMBERS and Heating Men thinking of going into business for themselves soon, can hasten that time by sending at once to Niebuhrs Plumbers Business Bureau, 105 Fifth Street, La Crosse, Wisconsin, for confidential information regarding financing, accounting, estimating, etc.

EXTRAORDINARY opportunity offered ambitious men to become distributors for new product being marketed. No competition: demand everywhere. Valuable exclusive rights free. Complete sales helps and full co-operation assures success. Start small and grow. $1,000 automobile free. Opportunity to establish business netting $10,000 yearly. Garfield Mfg. Company, Dept. E, Garfield Building, Brooklyn, New York.

SILVERING mirrors. Exclusive French tartaric process. Open enormously profitable business. Write P. Barstow, 514 23rd Street, Oakland, California.

IF you can sell our specialties in quantities, you should write for our Silent Salesman Catalogue. It is the secret to your success and it's free. Joseph Hagn Company, Wholesale and Manufacturing Jewelers, Dept. S, 223 West Madison Street, Chicago, Illinois.

STAMPS AND COINS

51 different stamps, also packet 5 unused, China ship set, 2 scarce animal stamps, large $1.00 U. S. revenue, perforation gauge, millimeter scale, ruler and price lists. All for 9c. Sudden service approvals. Fennell Stamp Co., Dept. C., Fullerton Bldg., St. Louis, Missouri.

CALIFORNIA gold, quarter size, 27c; $1/4$ size, 53c. White cent and catalogue 10c. Norman Shultz, King City Missouri.

500 different stamps $1.40; 200, 28c; 100, 12c; approvals. Michaels, 5600 Prairie, Chicago.

158 Genuine Foreign Stamps—Mexico War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., only 10c. Finest Approval Sheets 50% to 60%. Agents wanted. Big 72-p. Lists Free. We buy stamps. Established 25 years. Hussman Stamp Company, Dept. 55, St. Louis, Missouri.

STAMPS, 20 All Different, 3 cents. Mention paper. Quaker Stamp Co., Toledo, Ohio.

$2 to $600 paid for hundreds of old coins dated before 1895. Send 10 cents at once for new illustrated coin value book. Size 4x7. It may mean your fortune. Clarke & Co., Coin Dealers, Box 76, LeRoy, N. Y.

17 varieties Bulgaria stamps, 20c. List of 7,000 varieties low priced stamps free. Chambers Stamp Co., 111C, Nassau Street, New York City.

STAMPS—50 varieties, Transvaal, Brazil, Peru, Cuba, Mexico, etc., and Album 10c. 50 different U. S., 25c. 1,000 hinges, 12c. 1,000 mixed, 40c. List free. I buy stamps. C. Stegman, 5949 Cote Brilliante, St. Louis, Missouri.

CALIFORNIA gold, quarter size and Columbia Nickel, 30c. Villa coin and catalog, 10c. Homer Schultz, Union Star, Missouri.

STAMPS—50 different British Guiana, China, Jamaica, Portugal, Venezuela, etc., 10c; 1,000 all different, fine collection in itself, $5.00; 100 var. U. S., 30c; 1,000 hinges, 10c. Agents wanted. 50%. List free. I buy stamps. L. B. Dover, Longmont, Colorado.

STAMPS free! 60 all different for the names of two collectors and 2c postage! 30 Sweden stamps 10c; 20 Denmark stamps 10c. Toledo Stamp Company, Toledo, Ohio, U. S. A.

OLD coins, large fall selling catalogue of coins for sale, free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101-A Tremont Street, Boston, Massachusetts.

FREE! 25 different British Colonials to applicants for approvals. Postage 2c. Nickles, 122 Florida Avenue, Washington, D. C.

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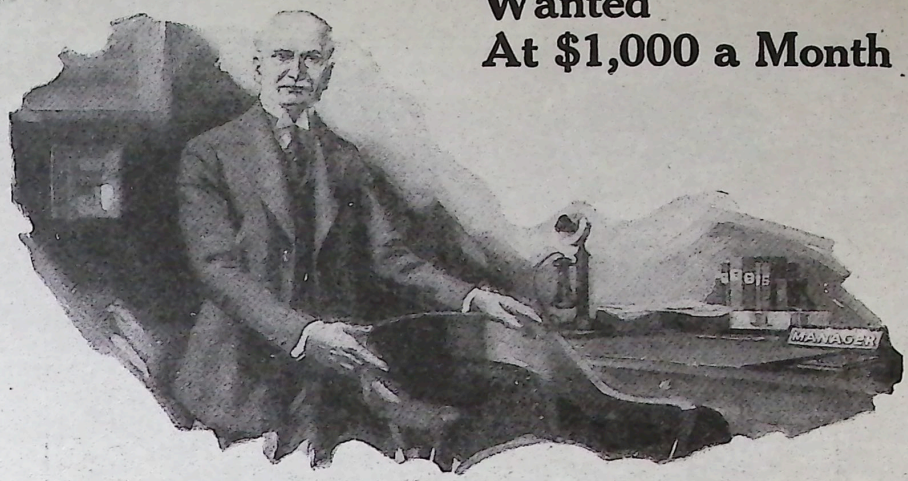

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THE practical value of this service has been tested by men holding responsible positions in practically every large corporation in this country, including 364 employees of Armour and Company; 390 of the Standard Oil Company; 811 of the American Telephone and Telegraph Company; 309 of the United States Steel Corporation; 214 of the Ford Motor Company; 303 of Swift and Company, etc.

HIGH-GRADE positions are always seeking applicants of superior intelligence and training. By our methods we find employees in subordinate positions who have the inherent ability to direct responsible work, but who need only the proper vocational guidance and special training that we supply to make them high-priced men. For instance, we developed a $20 a week ledger clerk into a $7,200 a year Auditor; a $70 a month shipping clerk into the Traffic Manager of a big rail and steamship line; a $300 a month accountant into a $70,000 a year executive; a small town station agent into a successful lawyer and district attorney; a bookkeeper into a bank executive, etc.

ADVANCEMENT is not a difficult problem for men who prepare themselves for promotion thru LaSalle training. A short period of preliminary training by mail, under the personal direction of LaSalle experts, has been sufficient to increase the earning power of thousands of men from 100% to 600%.

IF YOU are really ambitious to place yourself in a position of higher executive responsibilities in line with your natural qualifications, and without sacrificing the best part of your life in waiting for bigger opportunities, write us fully and freely as to the kind of position it is your ambition to fill. We will advise you promptly how our training and service may be of advantage in solving your personal problem of advancement. We have an organization of more than 1,750 people; financial resources over $4,000,000, and representatives in all the leading cities of America. Our sole business is to help men to better positions.

IT WILL cost you nothing to investigate this opportunity, and you may find out some surprising possibilities about yourself and your future that are unknown to you now. Mark and mail the coupon below, indicating the kind of position for which you would like to qualify. We will send full particulars, also a free copy of "Ten Years' Promotion in One," a book that has been an inspiration to more than 225,000 ambitious men. Send for your copy **now.**

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"The Largest Business Training Institution in the World"

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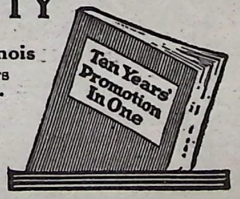
Send me free "Ten Years' Promotion in One," also catalog and particulars regarding course and service in the department I have marked with an X.



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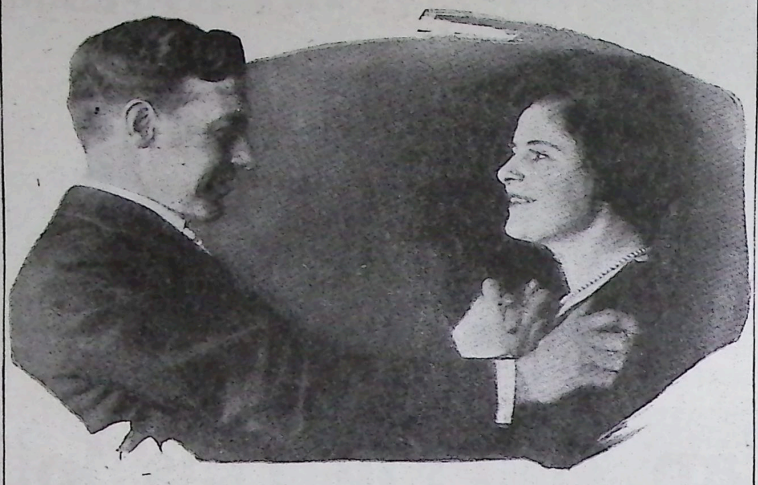

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and tried to ride a bike for the very first time? You thought that you would never learn and then—all of a sudden you knew how, and said in surprise: "Why it's a cinch if you know how." It's that way with most things, and getting a job with big money is no exception to the rule, if you know how.

We Will Show You How

Without loss to you of a single working hour we can show you a sure way to success and big pay. A large number of men in each of the positions listed are enjoying their salaries because of our help—we want to help you. Make check on the coupon against the job you want and we will help you to get it. Write or print your name on the coupon and send it in today.

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I want job checked—tell me how to get it.

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....Automobile Repairman.	*$2,500 to $4,000*	....Employment Manager.	*$4,000 to $10,000*
....Civil Engineer.	*$5,000 to $15,000*	....Steam Engineer.	*$2,000 to $4,000*
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....Accountant and Auditor.	*$2,500 to $7,000*	....Telephone Engineer.	*$2,500 to $5,000*
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No need of taking from one to four years to become a master electrician. You get ***intensive, individual and practical instruction*** in America's greatest and best equipped Trade School. Master craftsman always at your side to guide you.

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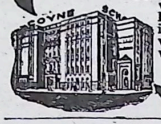

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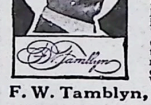

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Begin Today-Write for My FREE BOOK

I can make a good penman of you at home during spare time. Write for my FREE BOOK, "HOW TO BECOME A GOOD PENMAN." It contains specimens and tells how others mastered penmanship by the Tamblyn System. Your name will be elegantly written on a card if you enclose stamp to pay postage. FREE BOOK—Write for it Today.

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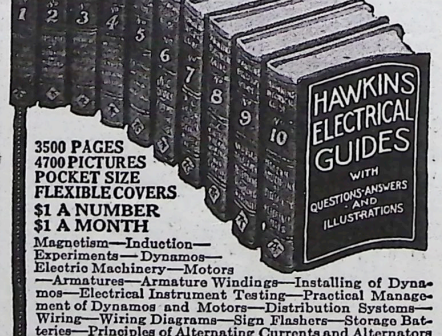

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SEND NO MONEY

THEO. AUDEL & CO., 72 Fifth Ave., N. Y. Please submit for examination Hawkins Electrical Guides (Price $1 each). Ship at once, prepaid, the 10 numbers. If satisfactory, I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Signature_____

Occupation_____

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How Would You Like to Earn $300 Next Week?

Col. A. W. Wilkie did it one day, and in 4 years jumped to almost $100,000 a year. J. F. Gibson jumped his earnings from $150 to $800 a month. Let me send you my secret of earning more money, to try 5 days Free. All you risk is a two cent stamp

By A. L. Pelton

MY name is Pelton—AlbertL.Pelton. Four years ago I was as poor as a church mouse. I was out of a job, $300 in debt, and my wife and two children were living on starvation rations. Yes, I've known the bitterest kind of want.

Today I have money and all that money will buy. I have my own home. I have no worries about high prices of food or clothing or rent.

Even if I never make another nickel, I don't think I will have to worry about money matters.

During the past three years I have been making on an average of over a thousand dollars a week.

That's quite a change from the time I was "on my uppers," isn't it?

Now let me tell you how I did it.

You will probably think I'm funny when I tell you that for twelve years I held in my hand the secret that at last won me riches.

But it's true.

For twelve years I struggled—with gold right in my hand.

It was this way.

I used to sell books—from door to door—eking out a poor man's living.

One of the books I sold was written by Dr. Frank Channing Haddock.

I never thought much about the book—although I sold a few from week to week.

For twelve years I never even took the trouble to read it.

It was called "Power of Will."

I didn't know anything about will power.

What's more, I didn't care.

I thought it might be a good book for fellows who *had* to read it.

But I was too busy earning a living to bother about will power.

Probably I thought then, as tens of thousands think today, who've heard and read about this great book—that will-power was some myth, or impractical thing for dreamers.

You see—I hadn't analyzed the lives of the world's greatest men then, and discovered that will-power is the mightiest force men have ever known.

I was fooling myself—cheating myself fearfully, as I found out later.

One day I ran across a man who had purchased the book from me a few months back.

He stopped me on the street and said, "Hello, Pelton, say, I'd like to have another copy of that Haddock book,—can you send it up right away?"

I told him I would. Then I asked him casually if he liked it.

What he told me made me go home and *read* the book myself—for the first time since I began to sell it twelve years before.

That same evening I borrowed $300.

The next day I was in New York.

I secured the exclusive selling rights to the book.

Then I spent $150 for a page "ad" in the Review of Reviews magazine.

It brought me about $2000 in cash.

As fast as the money came in I shot it back into advertising.

When I got $2500 in cash I bought a half page "ad" in the Saturday Evening Post.

The first year I spent $50,000 in advertising.

The next year I spent nearly a hundred thousand.

I guess I've spent over half a million dollars since my first $150 "ad," and already 450,000 men and women—including great executives, international diplomats, famous authors, etc., also have taken up this study.

At first some people said I was crazy to advertise that book.

When they found that the book was selling—and that I was spending as high as *$20,000 a month* telling people about it, they said I had more nerve than sense.

But, my friends, all this time I was simply taking my own medicine.

I was telling people that the will was the motive power of the brain—that a strong will could batter down every obstacle to success—that weak will-power could be made strong, as easily as the muscles of the arm could be made strong—and that simply because they didn't *use* their will power.

I had strengthened my own will and was *using* it when people were calling me "crazy." And it was my *will power* that people called "nerve."

Anyway, it was the secret of my success. Without it I might still be plodding—still canvassing.

Or even if I had gotten up enough courage to advertise I might have made only a piker's success.

It was my will power that got me the $300 loan.

It was my will power that got me exclusive sale of Dr. Haddock's book.

It was my will power that made me plunge into advertising instead of going slowly.

And finally, it was my will power that made me say to the public—"Send No Money—Read Power of Will 5 days free. Pay me if you decide to keep it—Send it back if you don't want it."

That was a new sort of proposition to most people. They had nothing to lose—and a lot to gain, if the book was worth while.

So the orders came in by the hundreds—then by the thousands.

At times I was 15,000 orders behind—just couldn't print books fast enough.

And letters from readers came pouring in so fast I simply couldn't read them all. Col. A. W. Wilkie of Roscoe, S. D., wrote that one day's study of "Power of Will" netted him $300 cash, and that four years later, by using the methods Haddock formulated, his earnings had risen to nearly $100,000 a year. V. P. Coffin of Rochester, N. Y., wrote, about *one month* after getting the book—" 'Power of Will' already has produced an increase of $5,000 a year in my income." J. F. Gibson, of San Diego, Cal., said that since reading "Power of Will" his salary jumped from $150 to $800 a month.

Men like Judge Ben Lindsey, Supreme Court Justice Parker, Asst. Postmaster-General Britt, Governor McKelvie of Nebraska, Senator Capper of Kansas, Secretary of Agriculture Meredith, Governor Ferris of Michigan—and a host of other big men, show the class of leaders who have studied Haddock's methods.

Surely there must be something in "Power of Will" for you, my reader.

It helped me. It has helped half a million others. I could send you a circular mailed with hundreds of letters from readers. But, better still, see the book and read it 5 days *free.*

All you lose, if you don't think "Power of Will" will increase your earnings, is a two cent stamp.

It may make $300 for you next week—it might carry you upwards to $50,000 or $100,000 in a few years—I don't know. I do know it has made a lot of money for its readers.

I do know, too, that if you pass this offer by—if you are a scoffer and a doubter—I will lose only the small profit on the sale of a book—but you—you may lose the difference between peanut money and real money.

It costs only 2c stamp to mail the coupon.

Don't wait 12 years—as I did. You may have gold within your reach and not know it. Send for "Power of Will" *now.* You've seen my ads before—now answer this one and see if this masterful volume doesn't contain the one little push you may need to make your life rosy-red. Begin training your will by sending in the coupon *this very second.*

A. L. PELTON.

Pelton Publishing Co.

14-T Wilcox Block, Meriden, Conn.

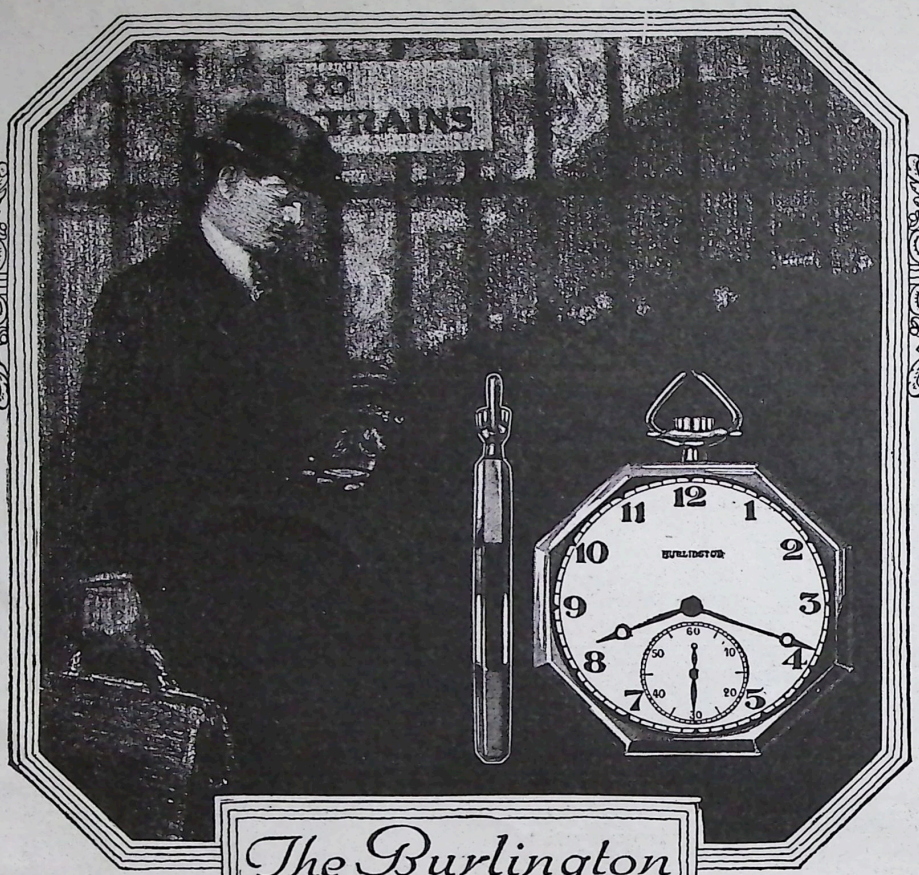
Pelton Publishing Company
14-T Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to remit $4.00 or remail the Book to you in five days.

Name.....

Address.....

City.....



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21 Jewels-Rubies and Saphires

"Fewer Jewels Not Worthy of the Name Burlington"

Only $3.50 a Month

Adjusted to the Second - Adjusted to Temperature - Adjusted to Isochronism - Adjusted to Positions
25-Year Gold-Strata Case - Genuine Montgomery Railroad Dial - New Art Designs - Extra Thin Cases

YOU pay only this small amount each month for this masterpiece, sold to you at the direct rock-bottom price, the lowest price at which a Burlington is sold. This masterpiece of watch manufacture is adjusted to position, adjusted to temperature, and adjusted to isochronism. Send the coupon today for free book on watches.

Send the Coupon

You do not pay a cent until you see the watch. Send the coupon today for this great book on watches, and full information of the $3.50 a month offer on the Burlington Watch. Don't delay. Act right NOW.!

Burlington Watch Co., 19th St. and Marshall Blvd., Chicago, Ill.

Burlington Watch Co., *Dept. 1368 19th Street and Marshall Boulevard* **Chicago**
338 Portage Avenue, Winnipeg, Manitoba

Please send me (without obligation and prepaid) your free book on watches with full explanation of your cash or $3.50 a month offer on the Burlington Watch.

Name.....

Address.....

.....

Popular Science Monthly

Waldemar Kaempffert, *Editor*

November, 1920; Vol. 97, No. 5
25 Cents a Copy; $3 a Year

Published in New York City at
225 West Thirty-ninth Street

Carrying Milk in Tank-Cars

The cost of milk can be reduced by transporting it in tank-cars heated by live steam from the engine

By Joseph Brinker

The world is brought up on milk. Eight cents of the price you now pay for a quart of milk goes toward bringing it to your door. Therefore a better system of transportation means cheaper milk.

Mr. F. F. Craft, a milk expert of New York city, says that he can bring milk from the farmer's cow to your doorstep for three cents a quart.

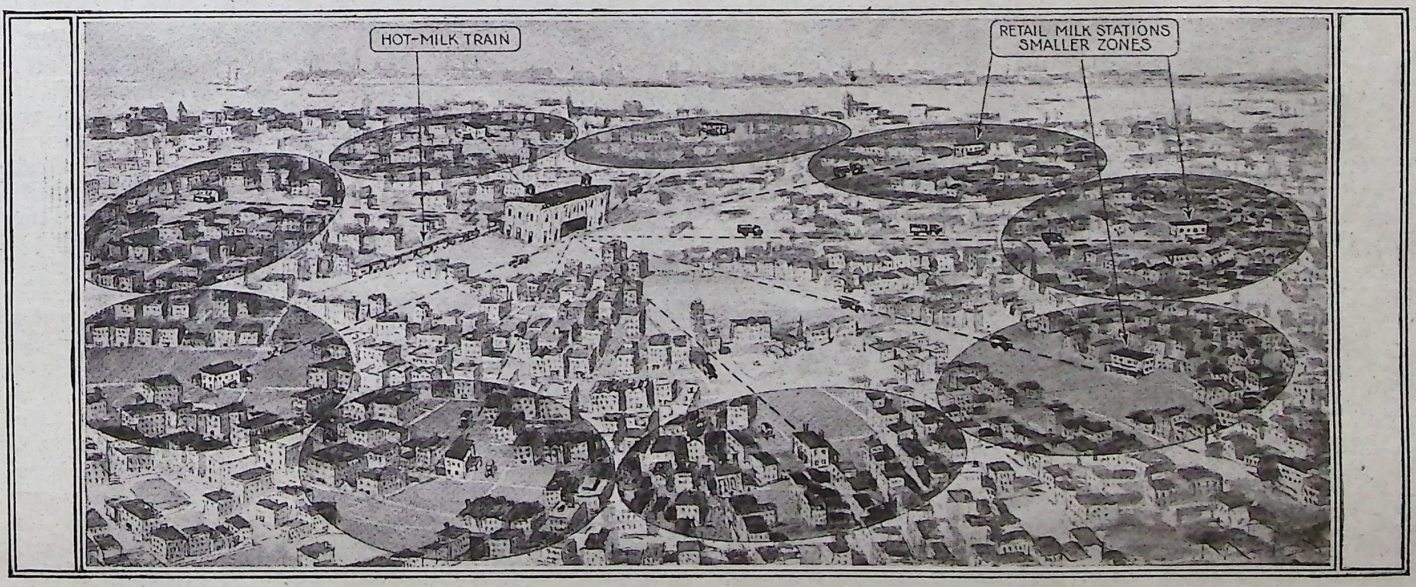
Children in the large cities die for want of milk. A reduction of five cents a quart would save lives.

UNDER average conditions, the quart of milk for which the farmer receives eight cents costs the housewife sixteen. In other words, the handling charges, plus the milk-dealer's profits, is equal to the first cost of the product. Under present conditions the rail freight per quart of milk is one cent when the milk is collected within four hundred miles of the city where it is ultimately sold. If the plan proposed by F. F. Craft, of New York city, is adopted, the freight charge can be cut in half.

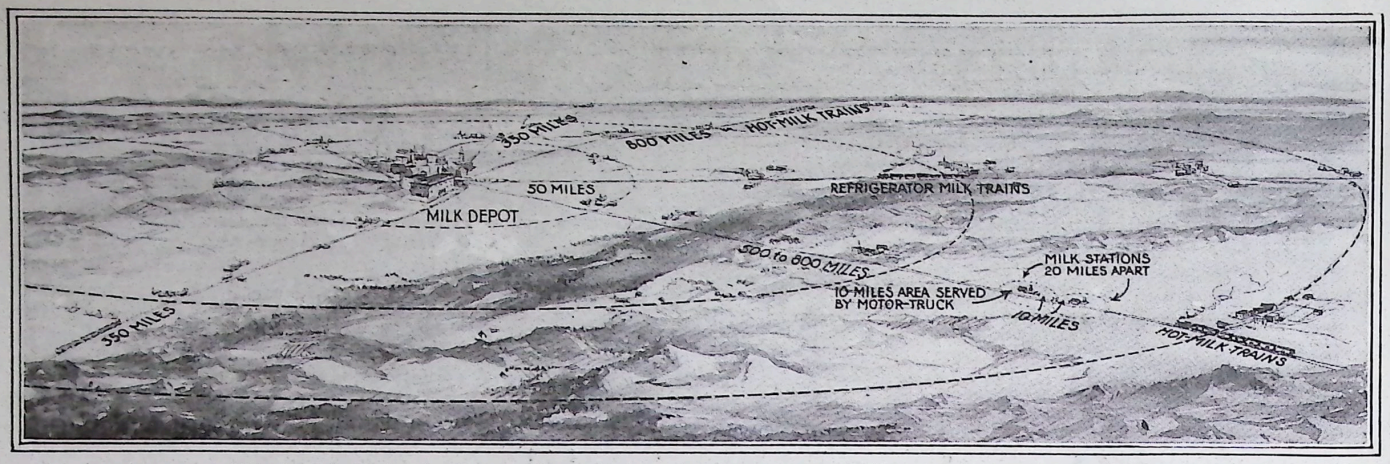
Mr. Craft's idea is to haul the milk hot instead of iced. This would permit the hauling of fresh milk for distances up to eight hundred miles — double the distance it is now practicable to haul cans of milk iced in transit. If this is done, it will eliminate a further increase in price due to a shortage of milk threatened by the inability of the present area of supply to keep pace with the demand for milk.

Less than ten years ago, New York had a population of approximately three millions. To-day the number is six millions. Has the territory from which New York's milk supply is secured increased? Statistics show that it has not.

As large cities like New York and Chicago increase in size, it will become more and more difficult to secure the



When the milk arrives at the city milk station it must be efficiently distributed. In a large city a system of "zones" containing the retail milk stations makes an easy solution of the problem of distribution



Here is a chart showing how milk can be brought from greater distances than are now possible by the usual methods of handling the dairy products. The tank-car solves the problem

required amount of milk. The only way to overcome this condition is to get the milk from points farther and farther away. Under the present method of hauling iced milk in cans, this distance cannot be increased because of the limitations of train speed and the inability to keep the milk from souring before reaching its destination. The limit has been reached, for milk trains traveling at passenger-express-train speed of forty miles an hour take at least ten hours to carry the milk from some sources to the city.

How the Present System Began

The first steam-railway milk train was run into New York city about thirty years ago. Then the milk was all collected within a radius of forty to fifty miles. Milk stations were built every three or four miles along the railroad by a private individual who received about ten cents a can from the railroad for every can of milk passing through his stations and hauled to its destination by that particular railroad. The railroad was glad to pay this small amount because it helped to build up its business. Then, as the city grew, the farms with from one to ten cows that were formerly on the outskirts were turned into residential suburbs or into large estates. The dairy farmers moved farther out, with the result that the milk had to be collected from greater and greater distances. This has gone on from year to year until now the limit is almost reached.

If an attempt is made to haul milk from greater distances than four hundred miles by some more intensified method of ice refrigeration, the cost of ice and freight charges will make it impossible for that milk to compete with the milk collected within the four-hundred-mile radius.

But now comes a man, F. F. Craft, a milk expert of New York city, who proposes to change the entire existing scheme by heating the milk instead of cooling it to preserve it; to carry it in from seven-thousand- to twenty-thousand-gallon tanks instead of ten-gallon cans, and to bring it from double the distance at no greater freight charge, by saving in the cost of keeping it sweet while in transit.

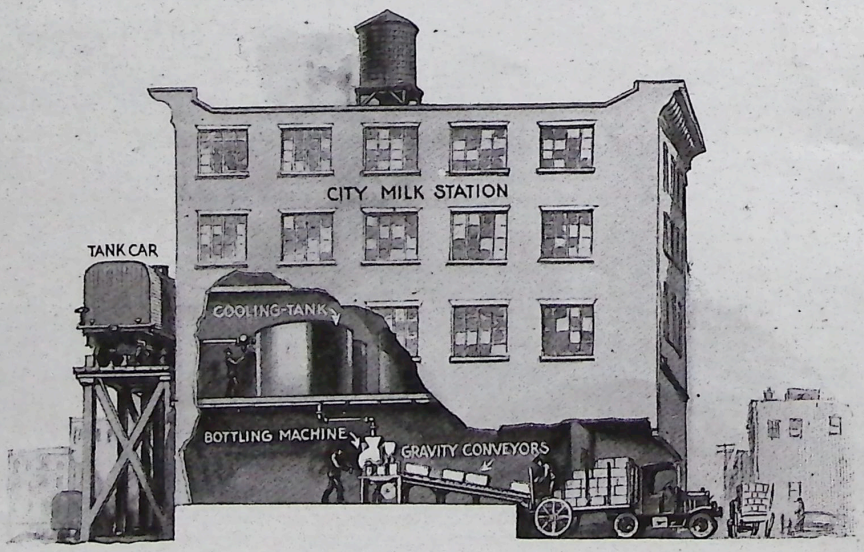
In the first place, he would use a huge steel tank mounted on an ordinary freight-car framework. This tank has a manhole at the top for filling, and is lined throughout with glass, so that not a drop of milk touches the metal. Around the outside of the steel tank is a layer of insulation, then an air space, and another layer of insulation, with an outside covering of corrugated iron to protect the insulation from engine sparks. The filling-pipe extends clear from the manhole almost to the bottom of the tank, and passes through a hollow glass-lined float that rests on top of the milk and prevents it from swashing back and forth and turning into butter while in transit over the long distances. As the tank is filled, the float moves up the straight sides of the tank, but always remains on top of the milk.

The space between the two layers of insulation is filled with live steam from the locomotive at a temperature of 125° Fahrenheit in the same manner as steam is now piped to heat ordinary passenger coaches.

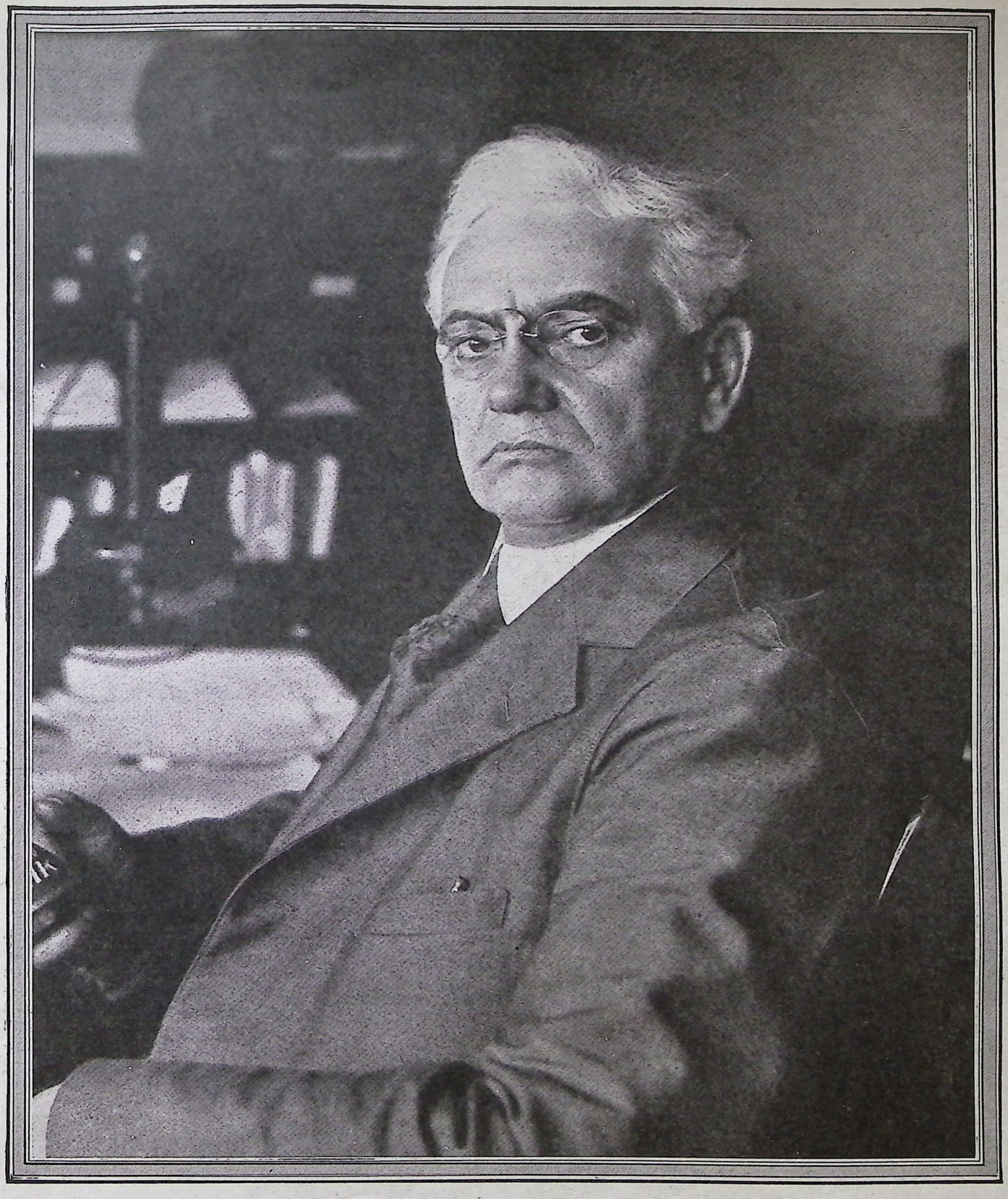
Temperature and Handling Economies

This temperature, sufficient to keep the milk, is about the same as that at which milk is now drawn off the Pasteurization tank. The temperature of each tank is kept constant by means of an ordinary steam thermostat such as is commonly used on the radiators of our newer office buildings and public schools.

But Mr. Craft does not consider the problem solved merely by the use of such a heated tank. He goes still further and eliminates many of the handlings that now go to increase the cost of milk to the consumer. At the point of railroad pickup he loads the milk directly into the tank-cars from the Pasteurizing plant, pointing out that, because of lower labor and rent charges, Pasteurization can be done more eco-



A city milk station, showing the method of getting the milk from the tanks and cooling it in the process of Pasteurization



He Would Transport Milk in Heated Tank-Cars

Fenton F. Craft was born in 1867 at Jefferson, New York, on one of the largest dairy farms in the state. He has been identified with the industry ever since and his knowledge of dairy conditions was valued so highly that his expert testimony was sought by the combined committees of New York city and New York state charged with investigating the high cost of milk.

While he was in charge of the largest butter-producing creamery in the state of New York the first Pasteurizing machines were introduced into this country. It was from these machines that Mr. Craft conceived his idea of transporting milk in heated tank-cars instead of in cans in iced refrigerator-cars. He claims that in the milk-tank car, milk at 125° Fahrenheit can be shipped one thousand miles at no greater cost than that for moving it three hundred miles under iced refrigeration.

nomically in the country than in the congested city. Because the milk is handled in larger quantities, there is no need for as many small stations as at present, and the new ones could be twenty miles apart. The territory within a radius of ten miles of each station could then be more economically served by motor-trucks than farmers' horse-wagons, and each of these steps would reduce the number of handlings and the price of milk accordingly.

Gravity Saves Man-Power

Arriving at the city milk station, Mr. Craft lets the milk flow out of the car-tank by gravity directly into the cooling-tank, from which it again flows by gravity to the bottling-machine, where it is cased and moved on roller gravity conveyors directly into the bodies of great ten-ton trailers hauled by motor tractors.

The saving effected by such a method of handling may be realized by contrasting the method with the present one, in which the milk is first placed in small cans on the farm; hauled to the nearest milk station in slow horse-wagons; unloaded and then loaded into the milk train; unloaded again at the city freight-station; and loaded into tractors, which carry it to the city milk plant, where the cans are again unloaded into the Pasteurizing tank, and from there into the cooler and the bottling-machine and thence to the waiting tractor.

From this point in the path of the milk from the farm to the table, Mr. Craft maintains that the price can be still further reduced by those who want milk at a lower cost by making the buyers go to distributing stations in their own localities instead of delivering it by wagon to the window-ledge, doorstep, or dumb-waiter shelf. Although he does not wish to deprive those who can afford to pay the price of doorstep delivery, he claims that the price should and could be reduced from three to five cents a quart by the "carry" plan.

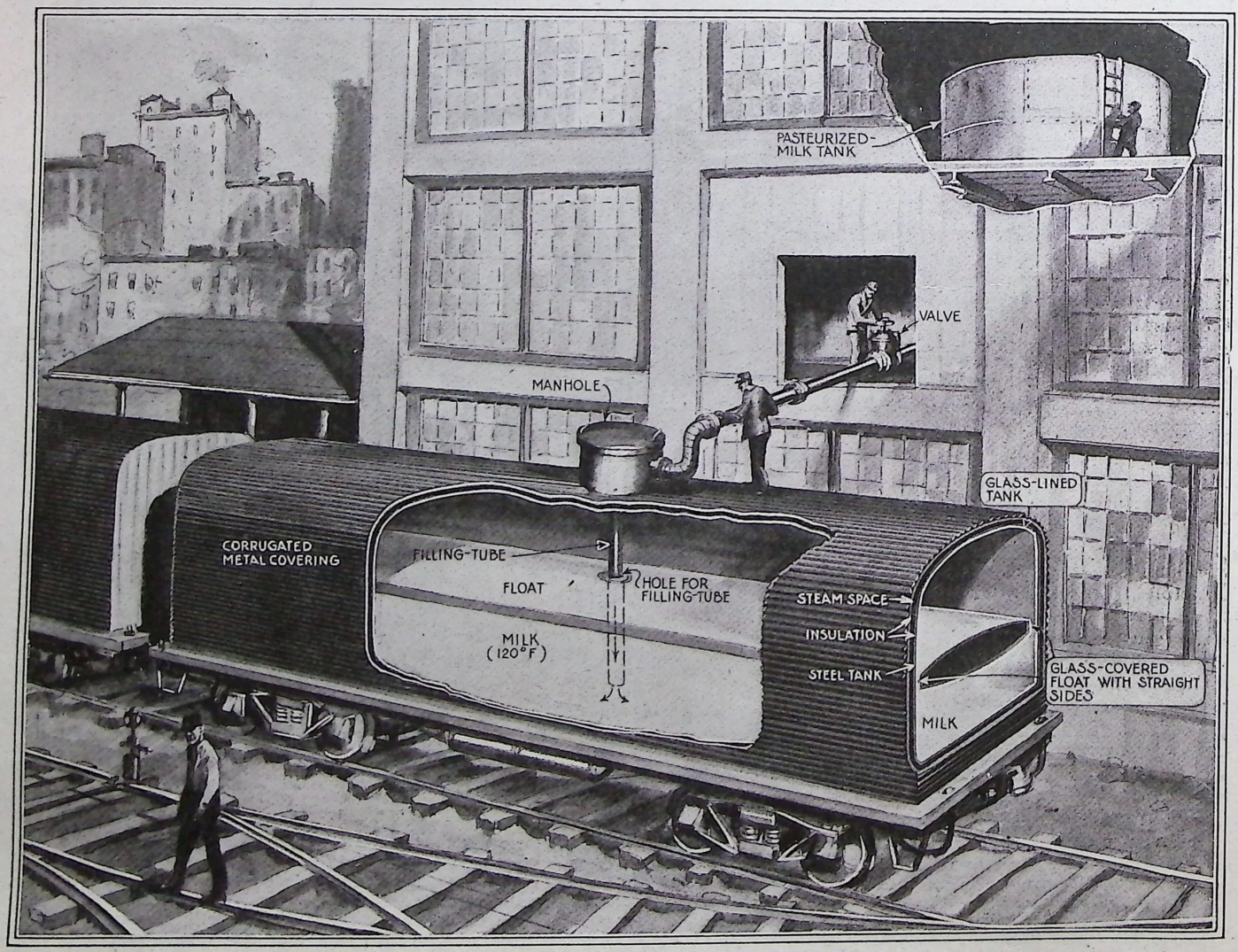
As contrasted with the present method of horse-wagon, door-step delivery, by which a driver delivers about 250 quarts a day at a cost of about three and one-half cents, he would ship the milk in huge ten-ton trailers and tractors. These can deliver to local milk stations or grocery stores approximately twelve thousand quarts a day in four trips at the rate of about one half cent a quart.

How the Price is Lowered

This would show a saving of three cents a quart, which, with the ability to buy milk from one to two cents a quart cheaper at double the distance from which it is now collected, would show a saving of from four to five cents a quart. This calculation assumes no saving in the freight cost, the saving in icing offsetting the cost of hauling over the longer distances.

An additional saving could be made by charging a deposit for every bottle taken from the local distributing station.

Under the present scheme, the average life of a milk bottle is twenty-two trips. If the buyers were made to find it worth while to return their bottles, the average life might be increased indefinitely and the price of the milk accordingly reduced.



Not an oil-tank, but a milk-tank, is illustrated here. The tanks will hold from 7000 to 20,000 gallons of milk. A glass-covered float prevents the milk from splashing

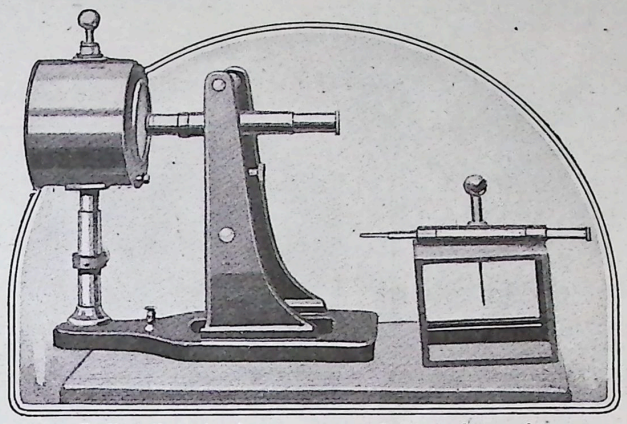
Lost! $6000 Worth of Radium!

The electroscope discovered it among the ashes

By Raymond Francis Yates

SIX thousand dollars' worth of radium was thrown into a furnace. It came out in the ashes. How it was found and recovered makes an interesting story.

A nurse was removing ten tubes of radium from a patient. She lost one in doing so. Six thousand dollars' worth of radium in a tube the size of your little finger! A diligent search of the room failed to reveal the presence of the little tube and as a final effort the radium detective was called for. In this case he was Professor Lawrence of the University of Rochester.



Ordinarily air is a non-conductor, but the invisible rays from radium render it conductive, and when the electroscope is brought near radium the gold leaf loses its charges and comes together

The radium detective did not arrive on the scene armed to the teeth or prepared for an encounter with some bold robber. He came in with a very simple looking instrument under his arm—an electroscope. The electroscope can detect the presence of radium in much the same fashion we would detect Limburger cheese if it were hidden away. The electroscope is sort of a "nose" for smelling radium and in this respect it is tremendously sensitive.

The electroscope is really an instrument for detecting electrical charges. We learned at school that like charges of electricity repel one another. For instance, if two tiny pieces of gold leaf both had a negative charge, they would insist on staying away from each other; they would repel each other. If one had a negative and one a positive charge, they would insist on remaining together, or, if they had no charges at all on their surfaces, they would be indifferent.

The electroscope works on just this principle. Two tiny pieces of gold leaf are suspended at the end of a metal rod enclosed in a glass vessel and carefully insulated, which means that it is prevented from coming in contact with anything that is a conductor of electricity.

If a glass rod is rubbed briskly with a piece of dry silk it will become charged with positive electricity. Part of this positive charge from the glass rod can be made to flow to the surface of the gold leaf in the electroscope by merely bringing the glass rod in contact with the projecting metal rod. At this instant the gold leaf will fly apart and remain in this position until a conducting substance is brought in contact with the metal rod. If this is done, the charges on the gold leaf will leak off and it will come back to its normal position. If an electroscope is allowed to stand in a charged condition the charges will gradually escape into the atmosphere. The rapidity of this leaking process will depend upon the condition of the air; whether it is dry or damp.

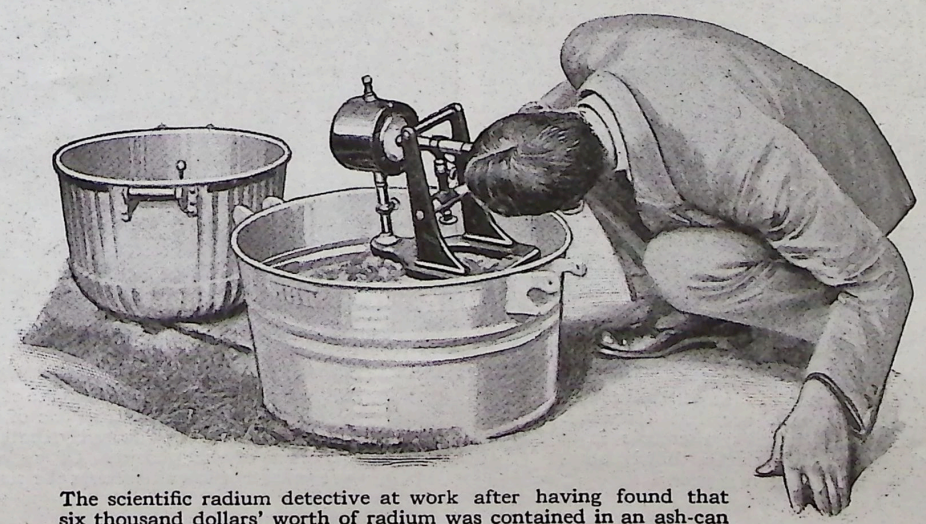
We will now set out to find the missing radium. Radium is continually shooting off tiny particles; atoms, really. Scientists call these emanations from radium alpha, beta, and gamma rays. Ordinarily air is a fair insulator, but when these radium rays get mixed up with it, its insulating or non-conducting properties rapidly vanish and it becomes a fairly good conductor. We can understand then that the air about a small quantity of radium—smaller than one can hope to imagine—is a poor insulator and if any charged bodies are present, their charges are sure to leak off into the atmosphere.

If an electroscope is brought near a small amount of radium, the gold leaf will instantly detect its presence by coming together. If the radium is some distance from the electroscope, the gold leaf may move just a very small distance, but the radium detective has a magnifier trained on it and if it moves he is sure to see it do it.

When Professor Lawrence set out to find the radium, he set the electroscope up in the room where it was used on the patient. The instrument failed to register. The radium had not been lost in the room. It was somewhere else. Probably the nurse got it mixed up with the bandages from the patient and it was thrown in the furnace. The ashes from the furnace were examined by the radium detective and, sure enough, the electroscope responded instantly. Further examination revealed the fused tube which contained the radium.

The radium was not lost. The search was continued until every possible milligram of the valuable metal was recovered. Radium will not burn.

After Professor Lawrence found the radium in the ashes, a hurry-up call was sent out for a physicist from a large radium company. After he arrived on the scene, the valuable ashes were placed in several quart fruit-jars and taken to the laboratory and all but $210 worth of the $6000 worth of radium was recovered.



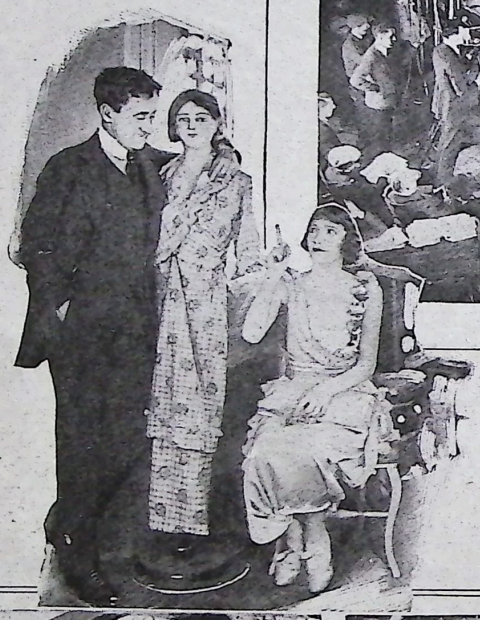
The scientific radium detective at work after having found that six thousand dollars' worth of radium was contained in an ash-can

How It Really Happened;

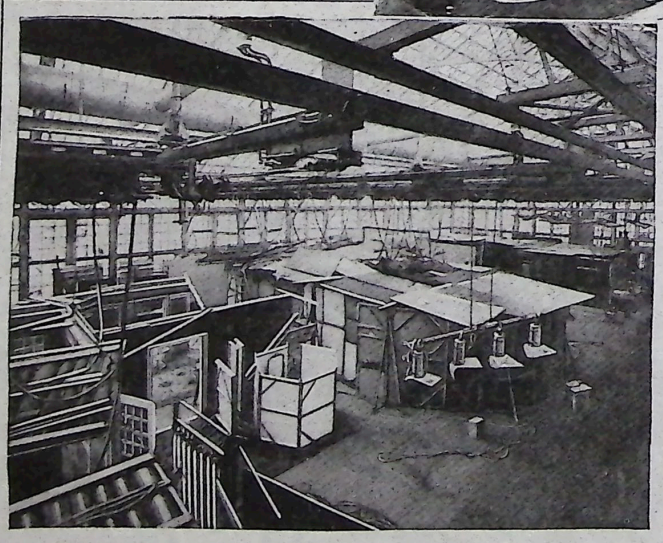
In which is shown that those film palaces are not always

The director here is seated in front of the camera, giving orders. But when the picture is taken, not even the edge of his hat will give his presence away. He is holding the scenario in his hand

An audience is having its picture taken, and, in order that it may register properly, an orchestra is playing appropriate music. Nearly as many people are needed to produce the picture as are needed to produce the audience



By means of her dummy Constance Talmadge is saved from hours of standing around while her director and cameraman decide on positions and lights. The dummy is just her height and has the same coloring—but the charm is lacking

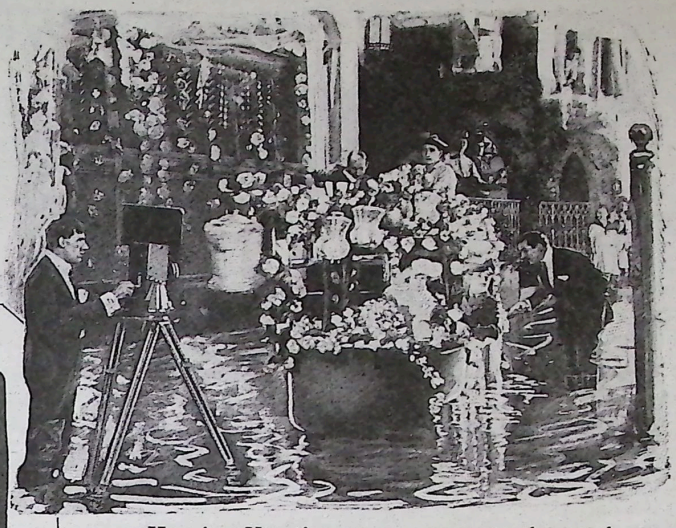


This picture shows a corner of a large studio after the day's work. Many sets are left standing. Everywhere are lighting fixtures; therefore it is not surprising that a studio's electric bill is sometimes a hundred thousand dollars a year

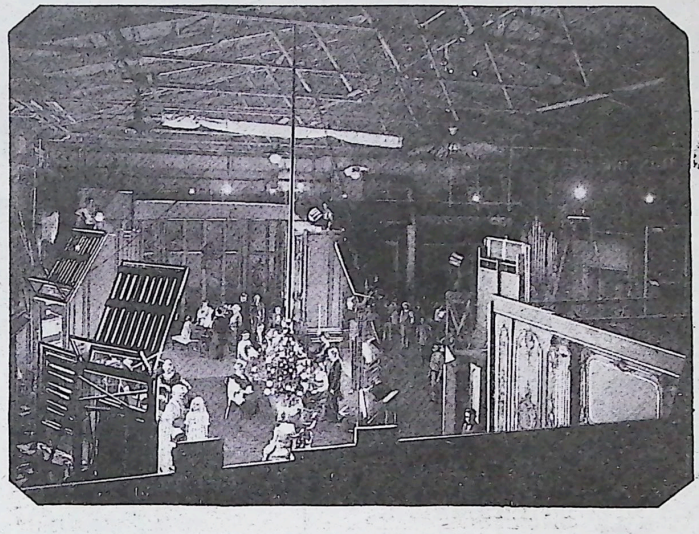
It is not a real hotel lobby, in spite of the convincing pillars. The set was built in one of the Hollywood studios. Notice how abruptly the balcony ends at the sides of the picture. Of course such rough details are not in evidence on the screen

or, Movies in the Making

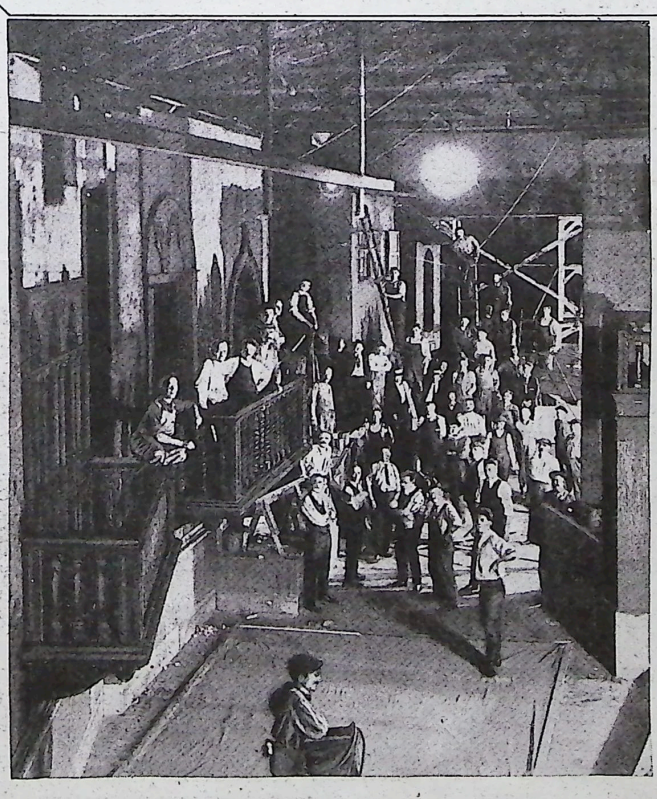
breath-taking thrillers of the what they appear to us to be



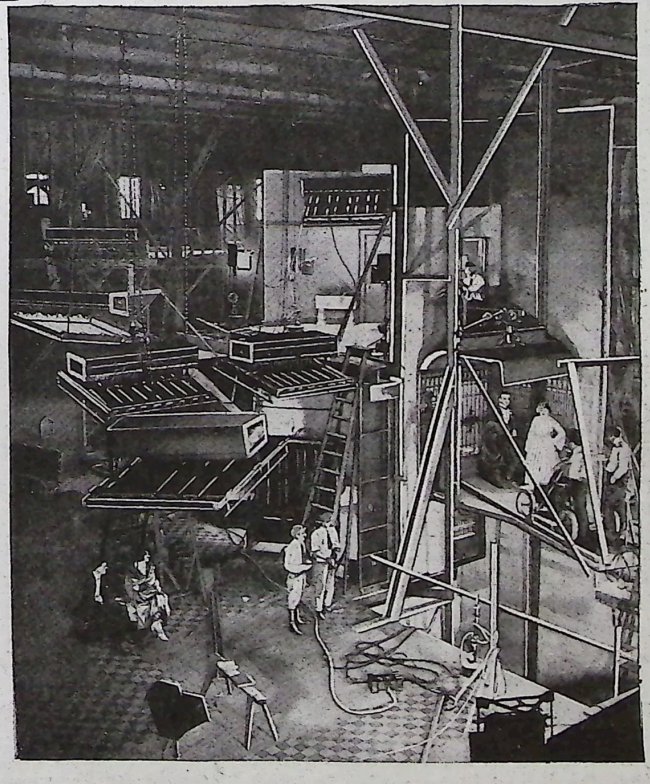
Here is a Venetian scene—even unto the canal. It's only a few inches deep, as can be seen by the high-water mark on the director's boots. He's telling the handsome stars to register love



Seeing this ballroom on the screen you would swear it was taken in some millionaire's home. In reality, it occupies little space. It is brilliantly lighted, however, and the proper light-and-shadow effects are produced



A moonlight scene on a canal in Venice—that's what these carpenters have been told to construct. Will they succeed in presenting a realistic scene to the thousands who will see this picture? Absolutely; they've never failed yet

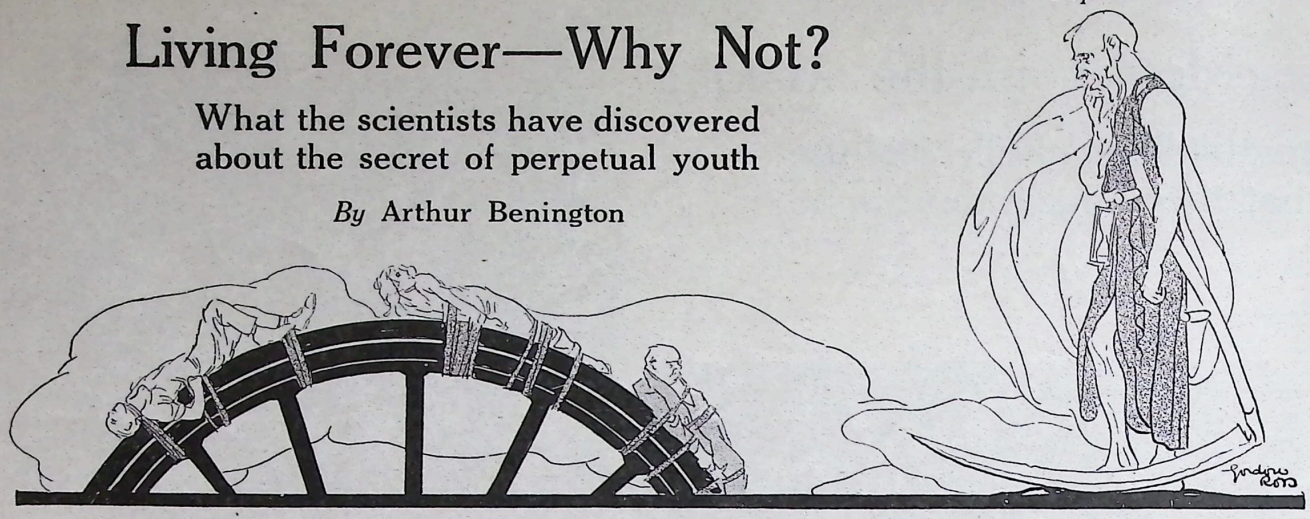


Half an elevator was needed for the picture, so half an elevator was built. The scene was supposed to have taken place in an expensive New York apartment. Who would guess that the elaborate landings were not real?

Living Forever—Why Not?

What the scientists have discovered about the secret of perpetual youth

By Arthur Benington



"I have taken old and worn-out sheep and goats; I have grafted on them the glands of a goat or of a vigorous sheep; and my animals were rejuvenated and gamboled about just as they did when they were young."
VORONOFF.

ANY one of us can get from an insurance company an estimate of how long he may expect to live. He will be told that the average American white man lives sixty years and the average woman sixty-four. That is to say, of all white children born in America, the average age at death will be sixty for males and sixty-four for females. And if he asks the officials of the Life Extension Institute, they will give him great piles of statistics to prove to him that the expectation of life for men and women who have passed forty has actually decreased and is steadily decreasing.

Our Lease on Life

According to C. H. Forsyth, in the December, 1919, issue of the American Statistical Association's quarterly, the expectation of life for a male white of native parentage at ten years of age, which in 1890 was 56.1, had fallen in 1910 to 54.1. And the expectation at forty, which in 1890 was 32.8, had fallen in 1910 to 29.9. A large loss in expectation was shown also by the native white of foreign or mixed parentage.

This seems a paradoxical result of all our modern science, all our vaunted hygiene, all our improved methods of medicine and surgery. What, one may ask, is the value of all this greater enlightenment and increased skill if it cannot add a year to our lives and is even bringing us to an earlier death?

The answer to this last question is double-barreled. First, our improved methods of taking care of babies are saving a host of weaklings that, but for this care, would have perished in infancy, and that grow to manhood without the natural stamina to resist the diseases that attack adults. Second, life has become so complex and strenuous that the human body has not yet been able to adapt itself to the stresses and strains that are the inevitable concomitants of the swift pace we are leading.

Why We Die

Dr. E. E. Rittenhouse tells us that there are always 1,500,000 Americans ill with preventable diseases; that four out of every ten deaths are preventable or could have been prevented.

Dr. Eugene Lyman Fisk tells us that, of 28,000,000 men between the ages of eighteen and sixty, 8,500,000 show evidences of approaching organic disease or already have it.

It is illuminating to read the causes of death. In 1917—a typical year, in which the figures were not complicated by the war—14.2 of every thousand persons in the United States died; out of every hundred thousand deaths 153.2 were from diseases of the heart, 149.8 from pneumonia, 146.4 from tuberculosis, 107.4 from kidney troubles, 82.9 from apoplexy, 81.6 from cancer, 79 from diarrhœa, 25.3 from diseases of the arteries, 17.2 from influenza, 16.9 from diabetes, 16.5 from diphtheria, 16.3 from bronchitis, 108.8 from accidents of all sorts. Arterial diseases and diabetes show an increase that is really alarming; for in 1900 only 6.1 per 100,000 died of the

Are We Wound Up Like Clocks?

Who has not looked forward a hundred years and wondered what the world will be like, and then thought, "I shall not be here to see it?" And yet—why not? Am I not a healthy man, in the prime of life, suffering from no disease of which I am aware, with a stomach that revels in Welsh rabbits at midnight, with a heart that pumps with the steady rhythm of a perfect steam-engine? And yet I would bet my life-insurance policies against a German mark that in a hundred years I shall be dead. You, too, are just as sure that you will not be here to see the year 2020.

Are we, then, wound up like a clock to run for a certain number of days and then stop?

We hear occasionally of men and women passing the century mark. We know the giant sequoias of California live for thousands of years. Dr. Eugene Lyman Fisk tells us there is no reason why we should not live for centuries. Why, then, are we so sure that we shall not see the next century?

In this article Mr. Benington reviews all that science has discovered to shed light on the question: "Why can't we live forever?"

former and only 9.7 of the latter. These, with those of the heart and kidneys, are diseases that result directly from the strain and stress of modern life.

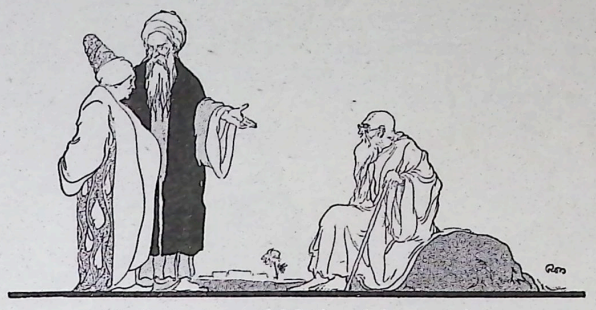
One has but to glance at the faces of a group of women of high society toward the end of the season to see the ravages that high living and late hours have wrought upon them. "It is the pace that kills." And it is the pace that brings on old age before its time. Many learned physiologists have speculated upon old age and its causes, and have written treatises to prove that we are all potentially immortal and might live for hundreds or even thousands of years, if we could avoid—oh, so many things! And they have pointed to the lives of famous old men as examples of what we ought to do to attain to their extraordinary length of days. The classic example is that of Cornaro, who lived comfortably to the age of ninety-eight, his secret being his diet, in which he limited himself to twelve ounces of food a day. A living example is Count Greppi, an Italian senator and former diplomat, who is hale and hearty at nearly one hundred and one. Count Greppi says his rule of life has been to allow himself no sensations—he assures us he has never loved!

If the price of passing the century be abstention from the joys of life, why live at all? Most of us prefer "a short life and a merry one" to a long life spent in clamlike seclusion.

Nature's Reason for Limiting Life

But mankind is not alone in growing old and dying. It shares this fate with all creatures, animal and vegetable. It seems that every species has its own allotted term of life, to which it adheres closely as an average, and Weismann has shown that this term among animals is usually that required for reproducing its kind and giving its offspring such parental care as it may need. Among plants, the fungi live but a few days; there are annuals, biennials, and perennials, of which the baobab is known to live 5000 years. Many insects live in the image stage only a few hours. The ephemerids rise from their grublike stage in the water, fly about long enough to mate, and die at once. They do not even eat, having no digestive apparatus.

On the other hand, there are locusts that live seventeen years from the day they are hatched. Eels live sixty years; pike two hundred; turtles live more than two hundred; small birds live seven or eight years; eagles more than one hundred; whales live several centuries; horses from fifteen to thirty years; elephants from thirty to forty, though it is popularly supposed that they live to one hundred years.



"And the days of Methuselah were nine hundred and nine years." No wonder men made long pilgrimages to see him

Parts of Us Are Immortal

But when we get far down in the scale of life we find creatures that never die—yes, and some that are very difficult to kill. The rotifers, for example, many of the bacteria, and some small nematodes can actually be desiccated and stored away in a dry place for a long time and then revived by moisture. Creatures that are unicellular are immortal—that is, of course, if some hungry thing does not come along and make a dinner of them.

More marvelous still, we are assured by such authorities as Professor Jacques Loeb and Dr. Alexis Carrel that every single cell of our own bodies is, or can be, immortal. Dr. Carrel has fragments of the heart of an embryo chicken, cut out eight years ago, which are still alive and growing. Leo Loeb has proved the immortality of cancer cells. Livers removed from the body and supplied with artificial circulation secrete bile and produce urea; kidneys under similar circumstances secrete urine, and hearts continue to beat.

And certain organs have been removed from men already dead, kept on ice for days, implanted or grafted into the bodies of other men, and lived. The glands of reproduction have been transplanted from the bodies of dead young men into those of living old men, and not only survived, but rejuvenated their hosts.

Thus it is demonstrated that the death of the body does not involve with it the immediate death of all tissues and organs.

If, then, every one of the myriad cells of our bodies is immortal, why, we may ask, can they not live as a group? Does life × life = death? To undestand this apparent paradox, we shall have to study the processes that go on with our bodies, beginning even before birth and ceasing only with death.

Our Body Cells Never Die

Friedrich von Mueller, lecturing at Munich five years ago, remarked that old age begins in adolescence, and that it would be almost true to say that we begin to die as soon as we are born. For death is only the climax of a long period of degeneration. A word we meet with constantly in medical literature is "metabolism." This is used to describe the process by which the cells of our bodies absorb from the blood the nutriment we give them in the way of food and oxygen and eliminate the worn-out matter.

These cells are formed of protoplasm; each has its nucleus, and every one of them had its origin in the splitting in two of another cell. They have many different forms, according to the work they have to perform in the body. There are nerve cells, muscle cells, bone cells, liver cells, gland cells, and a multitude of

Dr. Voronoff, who did some remarkable skin, bone, and gland grafting during the war. On a recent visit to the United States, this eminent French surgeon announced his willingness to transplant the interstitial gland of a dead youth to the living body of an old man

others. But all are essentially alike in that they are primitive cells resembling the unicellular animals at the bottom of the scale of life, and, like these, potentially immortal. They are all made of the four elements, carbon, hydrogen, oxygen, and nitrogen, and the processes of metabolism that take place in them all the time are nothing but chemical changes. They have the power of turning the simple molecules that are led to them by the blood stream—taken up by it from the food we eat—into the more complex elements of which they are composed (anabolism), and splitting up complex elements into simpler ones (catabolism). This is a process of oxidation, and the power to perform these chemical reactions — a power that is possessed by no chemist on earth—is inherent in each tiny cell.

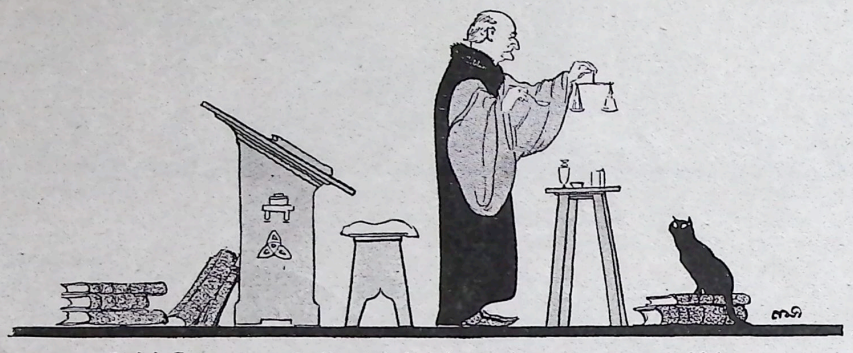
By this oxidation the cells keep all the organs of our bodies in working order, removing debris and repairing losses. The digestive juices in our stomachs and intestines prepare the food for absorption by the blood. Many persons have wondered why the cells of the stomach and intestines are not themselves digested by their own juices. Fermi says it is because the digestive ferments—principal of which are trypsin and pepsin—can not penetrate living cells; and Loeb suggests that the living molecule of protein is not hydrolyzable. However this may be, we know that living cells are proof against attacks from these ferments.

The Battle Waged within Us

In youth the metabolism is principally a process of building up. When full growth has been attained, it is an even balance between building up and breaking down; in other words, it is a mere keeping in repair. When the body is invaded by the germs of a disease, a battle royal takes place between the soldiers or policemen of the blood (called phagocytes) and the invading army of microbes. If the former be the stronger, the latter are killed, and we recover; if the latter be the more powerful, the former are so reduced in number that they can no longer protect the cells of our organs from the poisons liberated by the microbes, and we die.

There are diseases from which we may recover, but which leave certain organs in a weakened or wrecked condition—like the devastated regions of France and Italy after the invading Germans and Austrians had been driven out. Such an organ no longer performs its functions as efficiently as before.

There are also other diseases from which we never really recover; we may seem to, but the germs have merely barricaded themselves in such secret places as the marrow of our bones or the chambers of our brains, and they may break out again after many years.



Luigi Cornaro, an Italian of the sixteenth century, was told by his doctors that he would not live past middle age. He reduced his diet to twelve ounces of food a day and lived to ninety-eight

Some disease germs enter our bodies with our food; others are breathed in; others penetrate through a cut or abrasion.

Those germs that enter with our food find in our intestines a fertile field for their development. Metchnikoff attributed the onset of old age to the germs that flourish in the large intestine; he went so far as to say that if we had our large intestines removed, we should live longer, and he prescribed cultures of sour milk as an antidote to the poisons liberated by these germs.

Again, the cells in their perpetual work of metabolism tire; Laumonier has shown that they slowly degenerate and their walls thicken; thus they can no longer get rid of the debris, and they become clogged with the products of their own activity.

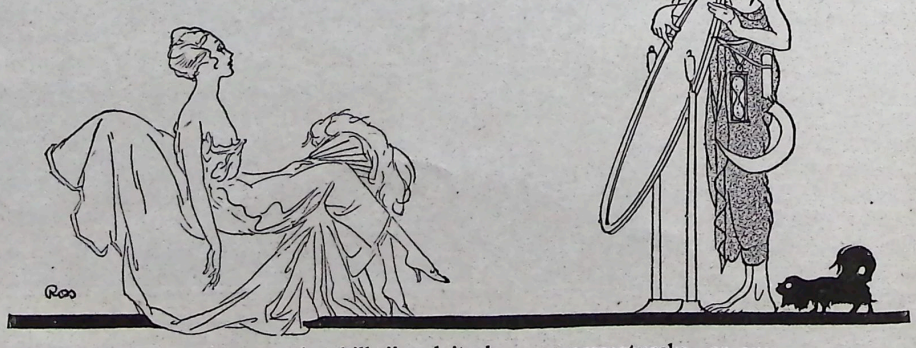
The cells of our bones collect lime, and this gradually takes the place of the gristly part, until, as we grow older, the bones become brittle. Too often our arteries share in this same kind of hardening. Improper diet, lack of fresh air, exercise and rest, overindulgence in such things as alcohol and tobacco, help all of these insidious processes by upsetting the metabolism, overtaxing the cells, and introducing foreign poisons into the system. And thus does our body begin to show signs of age.

Some organs degenerate before others. Friedman says our bodies begin to lose their elasticity after the very first decade of life. The thymus gland, in normal individuals, atrophies at puberty; athletes attain their maximum power before they are thirty and this then begins to wane; the eyesight starts on the downward grade at about fifty.

These phases are manifestations of the degradation or death of the cells of the organs affected, due to wear and tear and poison, the latter either introduced from outside or produced by the cells themselves (autolysis).

Repairing Bodies Like Clocks

Attempts have been made, and seemingly with some success, to repair artificially the organs that have broken down or worn out under the strain of living. In recent years we have heard much about the functions of the so-called "ductless" glands, and a new department of medicine, called endocrinology, has been built upon them. It is known that these glands—the thyroid, spleen, supra-renals, pineal, pituitary, and other glands, besides some of those that manufacture other secretions for which they have ducts, notably those of reproduction—produce certain secretions which they pour directly into the blood without passing through special ducts, and



"It is the pace that kills," and it also ages prematurely—as any society woman can see for herself at the end of a strenuous season

these secretions exercise a powerful but mysterious and as yet only partially understood effect upon our whole system. The thyroid gland, for example, situated in front of the throat on both sides of the "Adam's apple," affects our development. When it is absent or deficient at birth, the infant grows to manhood, but his mind does not develop and we have a "cretin," a twenty-year-old man with the mind of a child of two. When, on the other hand, this gland is enlarged or works too vigorously, exophthalmic goiter is the result. The endocrinologists are now curing cretins by administering extract of the thyroid glands of animals. And they sometimes cure exophthalmic goiter by cutting out the enlarged thyroid, but it is a dangerous operation.

Extraordinary results of experiments with thyroids have recently been obtained by Julian Huxley in England, and upon these some of the English newspapers have based highly colored articles in which his discoveries are hailed as an "elixir of youth," much as Dr. Brown-Séquard's discovery of the properties of the ductless glands was hailed in 1856, and as the grafting of interstitial tissue from the reproductive glands, described by Lydston, of Chicago, and reannounced by Voronoff, of Paris, was hailed a few months ago.

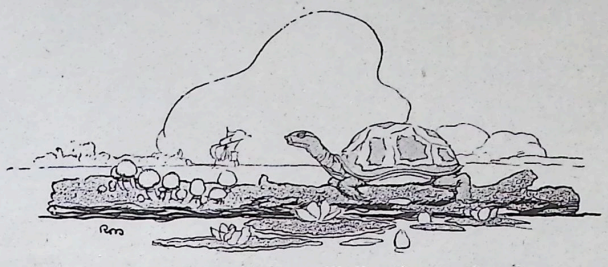
It is noteworthy that the widespread interest aroused by such discoveries as these is evidence of the almost universal desire to prolong, not life, but youth!

Experiments on Animals

Huxley's experiments were on several of the lower animals, to which he administered thyroid extract. Paramecium (a unicellular animalcule that multiplies by splitting in two), when fed on thyroid extract, split twice as often as normally. Tadpoles turned into frogs twice as quickly as usual, but ceased to grow, so that the experimenter had adult frogs no bigger than flies.

On the other hand, tadpoles from which the thyroid gland had been excised grew to a monstrous size, but remained tadpoles with tails and gills, never turning into frogs.

The axolotl, which is the larval or tadpole stage of a great salamander called amblystoma, lives in the marshy streams around the Gulf of Mexico, breathing through gills like a fish. Its adult form, living on land and breathing air through lungs, is rarely seen, and it is only a few years since an accident revealed that the former develops into the latter. A strange fact about this creature—or these creatures—is that, although the axolotl is only the rudimentary form, as the caterpillar is of the butterfly, it often lives and dies without developing further; it mates, lays eggs, and these hatch into new axolotls, while the adult amblystoma has never been known to mate or to lay an egg.



The fungi in this picture will live but a few hours; while the turtle may see its two hundredth birthday

By administering thyroid extract to aquatic axolotls, Huxley succeeded in hastening their transformation into land-living amblystomas.

Thyroid extract is given to human beings as a medicine to stimulate their metabolism. Kendall has calculated that one milligram of it, in the form of thyroxin, will increase the metabolism of a one-hundred-and-fifty-pound man two per cent, and he has established a regular scale of dosage on this basis.

After studying these and the many artificial methods now in use for repairing the deficiencies or the wear of our organs, and considering the multifarious plans for safeguarding mankind from the attacks of disease or for helping him to conquer it, well may one wonder why it is that we all continue to grow old and die, just as our fathers did before us. If our individual organs can be kept alive and healthy after we are dead, if the cells of our bodies can live on indefinitely, how is it that the totality of those organs and cells is doomed to perish?

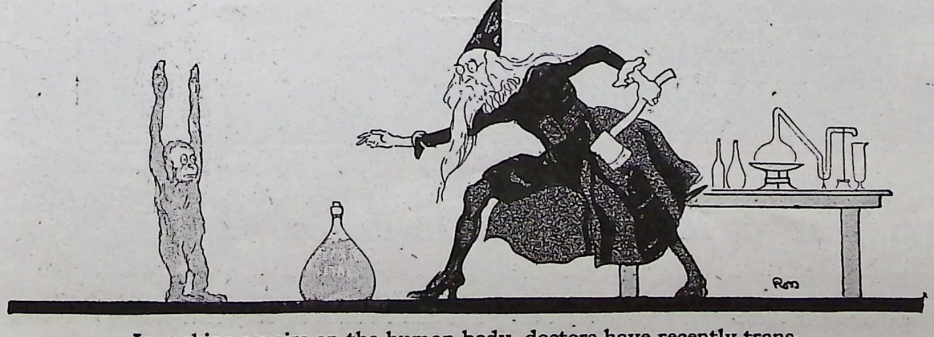
Professor Jacques Loeb, of the Rockefeller Institute, says: "Immediately after the cessation of the heartbeat and respiration, the cells of the muscles of the skin and probably of many or most other organs are still alive and might continue to live if transferred to another body with circulation and respiration. As a consequence of the lack of oxygen supply in the dead body, they will, however, die comparatively rapidly." For death is due to cessation of oxidation. As pointed out above, the activity of all the cells is merely a process of oxidation. To quote Loeb again, "While all the cells may be immortal, they can be so only in the presence of oxygen and the nutritive solution which the circulating blood furnishes. With the proper supply of oxygen cut off, they can no longer live." And "some accident sooner or later introduces the poison that reduces immortality to mortality."

No Way Yet to Beat Nature

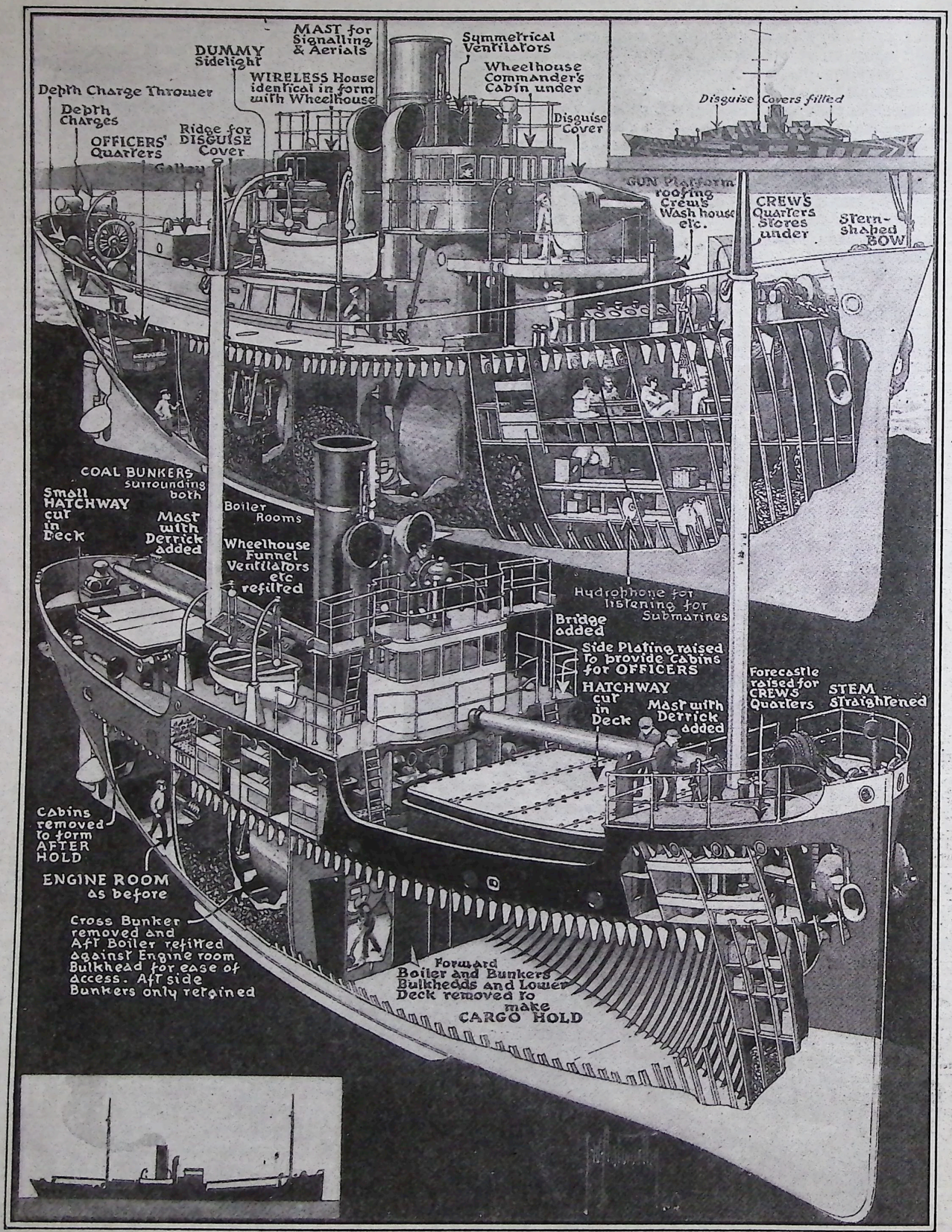
We have not yet learned how to attain long life, much less to conquer death. If we would reach a ripe and healthy old age, we must work less, play more, breathe pure air, avoid all excesses, pay stricter attention to water filtration and to the efficient disposal of sewage and garbage; we must free ourselves from the bondage of the house-fly and the mosquito; we must eat and drink in moderation—in other words, we must do, collectively and individually, all the well-known things that help us to defy disease.

But we should have begun with our ancestors, for most of us have inherited constitutional weaknesses or defects. It is useless to rely upon grafting of monkey glands or injection of thyroid extract. By these we may succeed in speeding up the motor for a brief time, but the ultimate effect will be like that of putting new wine into old bottles, or picric acid into the gasoline-tank of an automobile—the engines will work with unwonted vigor for a few hours, and then all is over forever.

Loeb suggests that every speeding up of natural processes is compensated for by a decrease in the span of life. And Dr. Edmond Perrier, commenting on the effects of thyroid extract upon the axolotl—transforming it from a breeding, egg-laying juvenile into an impotent, sexless adult—says: "If sterility is the price we have to pay for eternal youth—no, thank you!"



In making repairs on the human body, doctors have recently transplanted organs from monkeys to men with astonishing results



© Popular Science Monthly

Drawn by S. W. Clatworthy

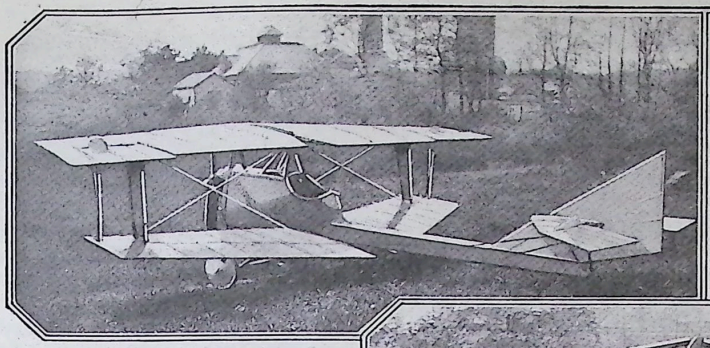
A Gunboat in War—a Merchantman in Peace

THE *Kilmore* was a British gunboat during the war; now she is a merchantman. She was converted from one to the other in two months! The picture in the upper right-hand corner shows the *Kilmore* in her war paint.

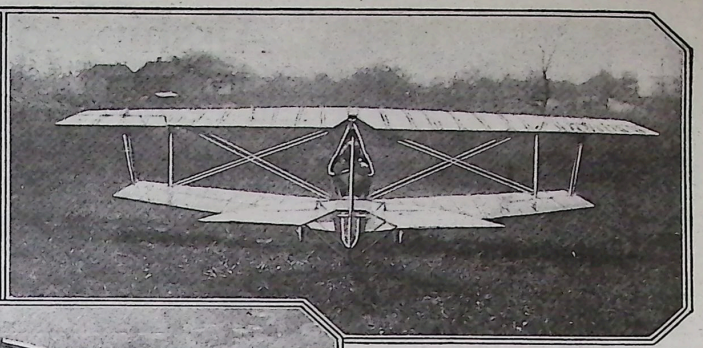
She had a stern-shaped bow, which made it difficult for the Germans to know whether she was coming or going. But now, with war paint off, and deck cut away, she is another vessel, as the picture in the lower left-hand corner shows.

Now she can carry five hundred and seventy tons of cargo at a speed of ten knots.

The conversion has been so successful that seven other ships in her class will also be made over into merchantmen



This tiny airplane costs no more than an automobile, needs no larger shed to live in, and will rise and land in our back yard



It is called a sporting airplane. No wonder! The wings can be taken off in ten minutes and the airplane turned into a tent

The Airplane for You and Me

"LET'S go flying!" You'll be saying that before long with the utmost calm. Take for example the new sport airplane shown herewith. It costs but two thousand dollars, and a gallon and a half of gasoline will run it for an hour. Moreover, War Department records show that flying accidents are no more frequent than automobile accidents, considering their numbers.

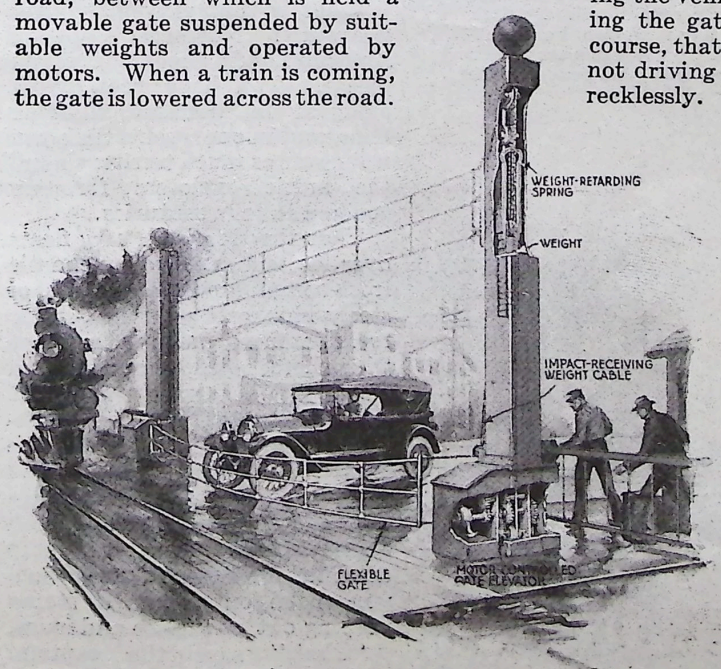
The new sporting airplane is much smaller than most. It has a two-cylinder, twenty-one-horsepower engine, with a maximum speed of fifty miles an hour. Its weight is only 425 pounds and it can land at the low speed of twenty-five miles an hour. A good sized lot will be sufficient for a landing-field. As for a hangar, any shed nine feet wide, twenty feet long, and seven feet high will do, because the wings are detachable and can be removed in ten minutes. A cable release lever makes this possible.

A Flexible Gate Stops Automobiles

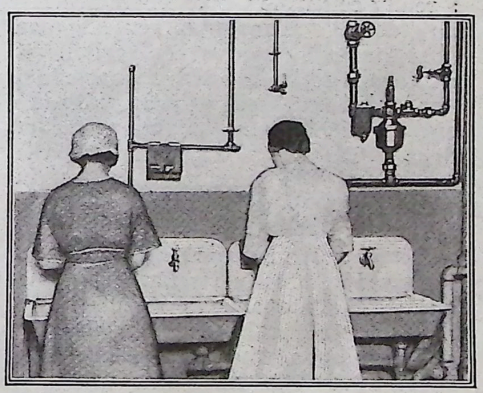
WHEN the careless chauffeur speeds toward a railroad crossing without heeding the "Stop, Look, and Listen" sign, there is likely to be an accident.

A barrier to prevent vehicles from encountering this danger has been invented by Joseph B. Strauss, of Chicago. His device consists of two supports on opposite sides of the road, between which is held a movable gate suspended by suitable weights and operated by motors. When a train is coming, the gate is lowered across the road.

If this obstruction were absolutely rigid, there would be a bad crash resulting from the sudden stopping of the truck or touring-car. But Mr. Strauss's clever design allows for such an occurrence by this flexible obstruction, one that "gives" to a certain extent when the heavy motor vehicle strikes it. This permits of a quick stop without capsizing the vehicle or demolishing the gate, providing, of course, that the chauffeur is not driving his vehicle too recklessly.



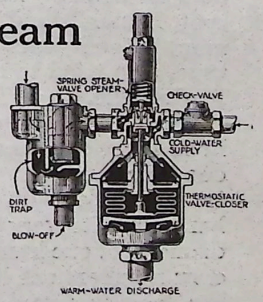
When an automobile reaches the railroad crossing, it runs into the flexible gate, coming to an instant stop



Open the hot-water faucet and you will obtain hot water heated to the desired temperature by steam

Heat Water with Steam

IF you have steam heat, a new heater will provide hot water instantly. Live steam and cold water are conducted to a central chamber in which the steam, through small openings, is brought into contact with the water. The water condenses and absorbs the steam and becomes heated.



From the mixing-chamber it passes to another chamber containing a thermostat. This instrument consists of a flexible metal bellows enclosed in a rigid shell filled with a volatile fluid, the boiling-point of which is a few degrees below the temperature of the water.

As the hot water passes around the shell, the liquid within is volatilized and exerts a pressure on the bellows proportional to the water's temperature. If the water is hotter than desired, the pressure of the volatilized control liquid forces the bellows down, and with it a thrust-pin, which controls the valve admitting the steam

By Airship to the North Pole

The Peary of the future will explore the frigid zone in a floating laboratory

By Lieutenant Clifford A. Tinker

NEWSPAPERS have always referred to the last desperate effort of a Nansen, a Scott, or a Peary to reach his geographical goal as a "dash for the pole." And a "dash" it is. A few dogs hauling a few sledges, one or two instruments, barely enough food to keep body and soul together—such is the equipment of the daring expedition that makes the supreme effort.

Now, a polar expedition is essentially a scientific undertaking. Its primary object is to increase the world's stock of knowledge. Science needs time to make its discoveries. It must have leisure in which to experiment and to penetrate into the unknown.

The "Admiral Peary"

A huge airship of the Zeppelin type will enable the explorer of the future to study the geography of the poles in a really scientific way. There need be no "dash." The great gas bag can float for days over a given region. It will accomplish in a week what could not be accomplished in years with the aid of whaling-vessels and teams of dogs. That exploring ship of the future—of the very near future, in fact—will be a veritable scientific laboratory.

Let us name her the *Admiral Peary*. Behold her, ready for her voyage to the north polar regions. She is housed at the great hangar at Spitzbergen, whence sailed the ill-fated Andrée and his companions in their free balloon, the *Ornen*, on July 11, 1897, never to be seen again. From the same spot, Danes Island, Walter Wellman, fifteen years ahead of the time, also tried to reach the pole by dirigible.

The *Admiral Peary*, streamlined from bow to stern, a giant one thousand feet long, reaches from the floor of the immense hangar to its very rafters. Her diameter is one hundred feet; her crew numbers one hundred men; her load is two hundred tons. You marvel at her bulk.

You enter this leviathan. You walk down the passageway. Countless steel trusses and latticed struts encompass you and extend almost as far as the eye can reach. These great tanks are filled with gasoline; those engines there equal the efforts of three thousand horses; that elevator takes you to the observation rooms one hundred feet above. The rooms along the sides are for the scientists. They are provided with many instruments and equipped with laboratories—the astronomer, the geologist, the ethnologist, the botanist, the meteorologist. Here are the quarters of the crew and officers; there are the pantries, the dining-saloon, the hospital, the lounging-room; in the center is the dynamo-room and the radio equipment. Even a huge telescope is mounted in a well-like compartment amidships. On top are placed the four auxiliary airplanes for emergency use. The photographic department is housed in an after compartment.

A walk of eight hundred feet along the metal-floored passageway toward the bow of the ship brings you to the streamlined pilot-house, which projects ten feet below the main ribs of the hull. You descend and report to the captain, who tells you that the start will be made in ten minutes.

The great doors of the hangar roll open, the ship slowly emerges. The engines are warming up. A deep-voiced gong resounds through the length of the dirigible, and the land drops away. The voyage has begun.

The time of starting and the hourly progress of the ship is sent by wireless to Washington. Thanks to radio, you are but two minutes from home.

The ship turns her prow westward. She crosses the open sea, so called by courtesy, for it is crowded by floating icy mountains. Great spreading floes, miles in extent, stretch out to meet the horizon. You wonder how far away that horizon may be. You step to the dial. The ship is at twelve hundred feet altitude, and thus it is forty miles to the horizon. Your range of vision includes an area of more than five thousand square miles. Think of that in the polar regions, where in times past an entire expedition has been so buried in by icy barriers that its members died of starvation, ignorant of the rescue party only a few miles away.

You are thrilled at the unending panorama, by the wonderful fields of snow and ice, and the stretches of water like blue veins between the floes, and the ghastly whiteness of the towering icebergs as they topple and swing with crushing force against other bergs or burst through some narrow floe to waters beyond.

Hark! The call to lunch. You proceed to the electrically heated dining-saloon to enjoy a four-course lunch, with salad and fresh fruit. You return to the pilot-house.

On top of the gas bag are the laboratories and cabins. And in the rear of this top-deck housing is an open hurricane-deck from which kites as well as sounding-balloons can be sent aloft

To the Pole in a Week

What is that gray mass over westward? Northeast Cape on Amdrup Land; Greenland, if you please. You have been flying along at one hundred miles an hour, and in one week's time you will cover as much territory as all the arctic explorers formerly covered in four centuries.

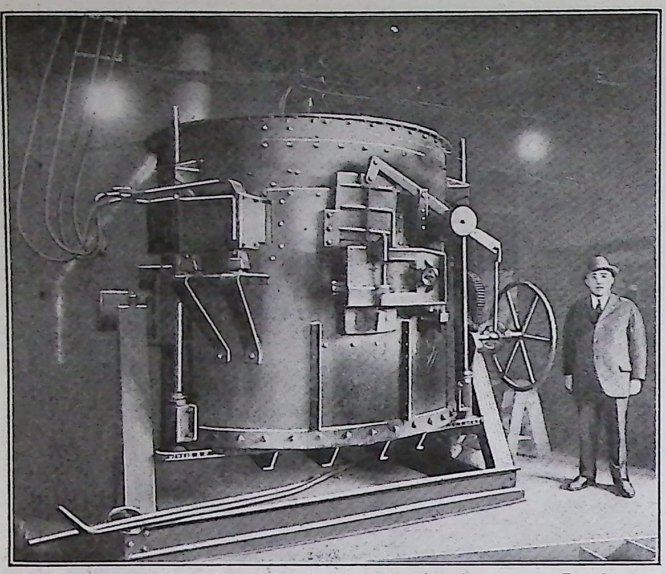
Thus the *Admiral Peary* floats over ice and snow, over chaotic frost-bound lands, over seas of steely blue, and gray wind-swept rock patches; on over the spots where heroes died, where wintered starving, desperate voyagers, where "Farthest North" was written, where hunger and disease turned back the brave. And then, at a certain hour, the captain calls your attention to a patch on the frozen surface. As the ship descends for closer investigation, you make out a pile of stones peeping out of the ice and snow.

"That," says the captain, with simple pride, "is Peary's North Pole cairn!"

To the North Pole by Dirigible Airship

A huge dirigible of the Zeppelin type will enable the explorer of the future to study the geography of the poles in a really scientific way. There need be no "dash." The great gas bag can float for days over a given region. It can even come down for a few hours.

In this picture we have shown it anchored by the head, so that the explorers may study closely the ice-bound region about the pole. The wind has lifted the tail of the airship, which accounts for its peculiar position. Not long may the explorers leave their craft thus anchored. Its position is precarious. The wind may beat its tail down upon the ice and wreck it beyond repair



Melting brass by electricity is a new development. It gives closer regulation of temperature and more uniform production

A New Factor in Brass

NEXT to iron and steel, the production of brass castings and rolled products is one of the largest of the metal industries.

To make brass castings and such rolled products as sheets, rods, etc., it is, of course, necessary to melt the original pure metals first, to mix them properly, and to pour them into molds as castings or into ingots that are later rolled. For a long time this has been accomplished by means of crucible furnaces or gas- or oil-fired furnaces. Whether melted in crucibles, or oil- or gas-fired, only small quantities can be melted at one time; but of the two processes, the oil- or gas-fired is to be preferred.

Recently a new and interesting development has taken place in the melting end of this industry—melting by electricity. The development of the electric furnace as a melting medium for brass and copper and other non-ferrous alloys has largely taken place in the past two years.

Electric melting has several advantages, among which are closer regulation of the temperatures, smaller loss by volatilization and spills, the handling of larger quantities at one time, and greater uniformity of product.

Electric melting was first used in melting silver. In a few years it has spread to brass of all kinds, coinage metals and alloys, aluminum and some of its alloys, and to other fields.

The constant appearance of new non-ferrous alloys, some involving the use of the rarer metals, new uses for the more common alloys and metals, and the unlimited possibilities for new combinations assure a wide use for the electric furnace.

Teeth Sharpened While You Wait

THE Wakamba dentist does not look for cavities—he makes them. He chisels and then files his patients' teeth until each tooth ends in a sharp point. Why? So that his patients can tear raw meat with neatness and despatch.

The Wakamba tribe is one of the least civilized tribes of Africa. The men will sell their wives for a few cows. Everybody eats raw meat; in fact, very little cooking of any kind is done.

The idea of having one's teeth chiseled and filed is not attractive, but the Wakamba men don't mind it at all. One of them is shown below reclining in his dentist's arms.

© Kadel & Herbert

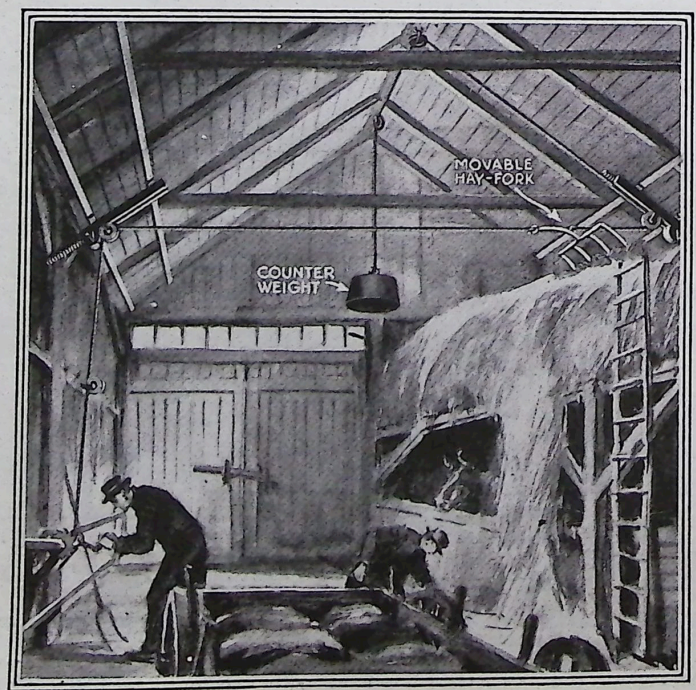
The Wakamba have no cooks. In order to eat the raw meat, they have their teeth filed to sharp points

Among the Wakamba, one of the least civilized African tribes, the dentist *makes* cavities in teeth

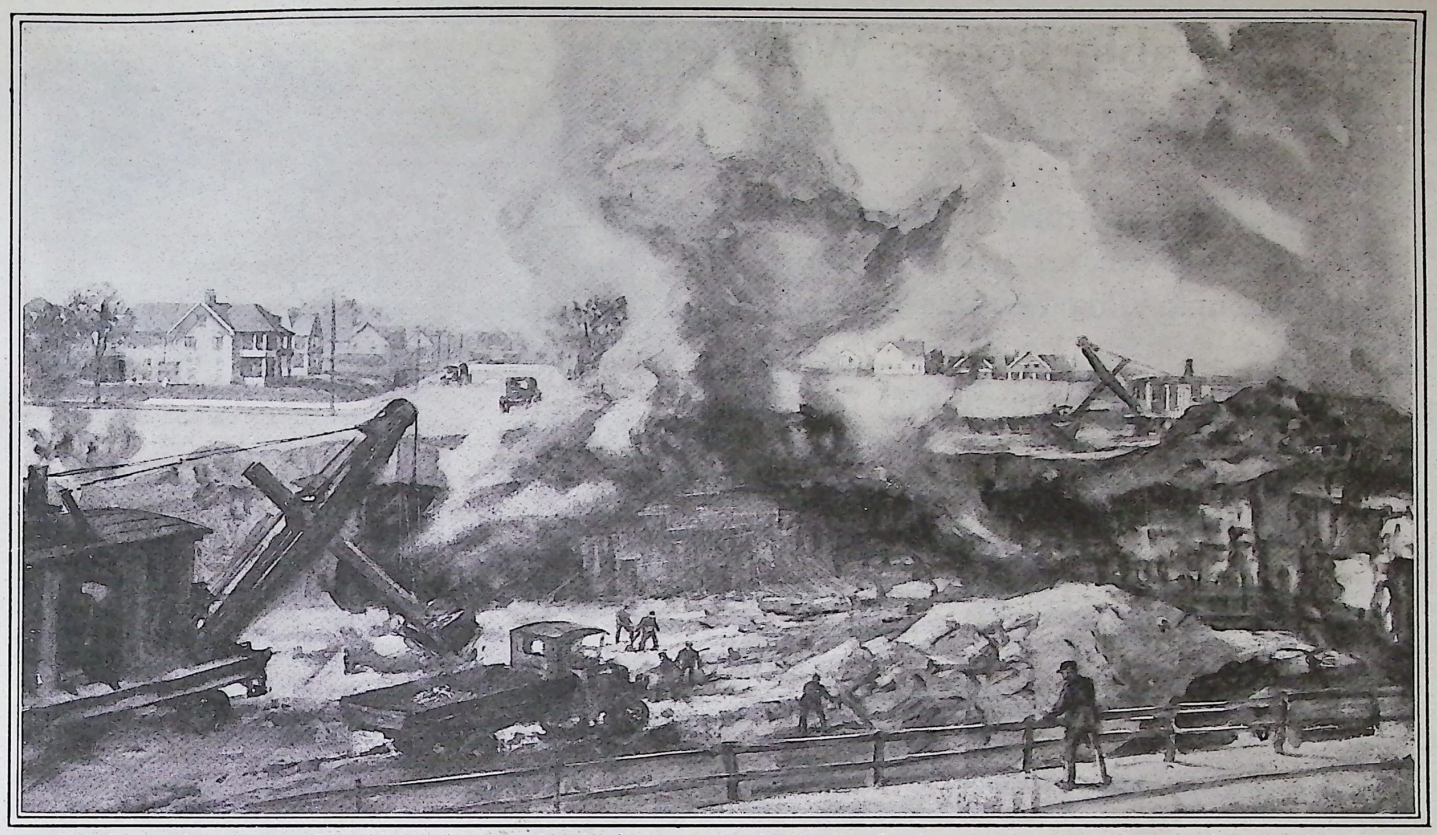
Hay Forked Down Automatically

FOR a long time inventors have been designing machines for getting hay into the hay-loft, but none of them have worried about getting it out again. George Chromy, on the contrary, has felt the need of such a mechanical hay-puller and has therefore invented one.

A handle, a weight, and a fork, properly connected, constitute the chief features of this machine. Start with the handle. When the farmer wishes to pull down some hay, he turns the handle, thus causing a rope to wind around a drum. This rope passes over a series of pulleys attached to the roof, and terminates in a hanging weight. To that section of the rope that passes over the hay, a fork is attached. Thus, when the farmer turns the handle, the fork drags across the hay and pulls it down. Then, when the handle is released, the weight pulls the fork back to its original position, ready for a second trip.



Turning the handle pulls down some hay from the loft. Releasing the handle pulls the fork to its starting position



Steam shovels at work, stripping the area of coal. It was no job for the city fire department; engineers had to be called in

Fighting a Burning Coal-Mine Under a City

The battle is still being waged

By James Hope

THERE is a coal-mine burning under one of Pittsburgh's most exclusive residential sections. The fire started in 1914. A few months later it spread rapidly and became a source of great danger to the community. To know that a fire is burning under the street you live on, with the possibility that it may actually extend under your home, would not add anything to your feeling of comfort and security.

The people in the Squirrel Hill section of Pittsburgh, where the fire occurred, did not give the matter much thought until the street above the burning mine became so hot that pedestrians were unable to walk upon it. The street was completely undermined by the fire, and part of it caved in.

The Engineers' Plan

This was no job for the fire department. Putting out mine fires is a job for engineers. Water could not be used, and it would not do any good even if it were possible to apply it.

When the city engineers reached the fire and studied it, they decided to dig down a short distance and build a clay wall or barrier beyond which it would be impossible for the fire to spread. This plan was put into effect, and it was thought that the fire would soon burn itself out. But the engineers were disappointed. The fire did not burn itself out. It grew hotter and hotter. The heat caused the clay wall to crumble, and the fire spread rapidly to thicker coal deposits.

There was another hurry-up call for the engineers. This time they decided to strip the vicinity of coal as far as possible, and steam-shovels were put to work. The excavation was carried on with great haste to prevent the fire from spreading to sections forty feet beneath the surface. To permit the fire to reach these areas meant almost complete disaster to the entire community. It was very difficult to fight the fire at depths varying from ten to twenty feet. At a depth of forty feet, effective work would have been almost impossible.

Coal, One Dollar a Ton

The race with the fire continued for some time. Steam-shovels dug frantically. Coal became so plentiful that it was sold to the people in the neighborhood for one dollar a ton. At times during the operations burning portions of the mine were exposed. Although the fire was subdued to a great extent, it was not entirely extinguished. The battle with it is still being waged.

A Constant Supply of Oxygen

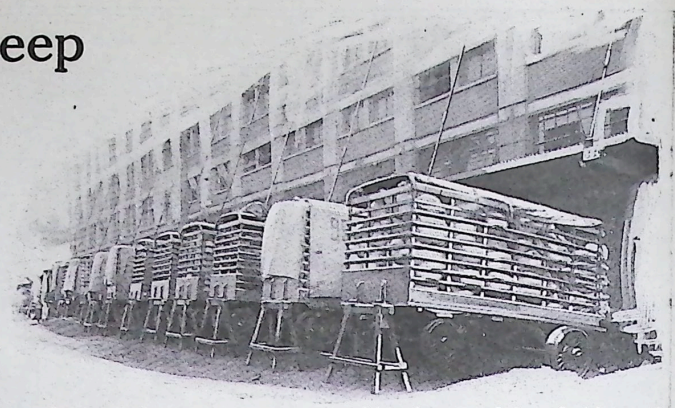
The coal-mine in which the fire started is a very old one. It has been abandoned for forty years. The fire received its necessary supply of oxygen through several openings. It is difficult to imagine how ferocious a coal fire may become, burning underground. As the oxygen is used up in the combustion of the coal, a partial vacuum is created. This lowering of pressure causes air to find its way in from the outside and the fire never lacks a fresh supply of oxygen.

Coal-mine fires are not uncommon, but they usually occur in unpopulated districts where they are allowed to burn themselves out, owing to the great cost of extinguishing them. A coal-mine burning under a city is a more serious matter—it simply must be put out regardless of cost and trouble. If it is allowed to reach deposits that extend beyond a certain distance underground, the job of putting it out becomes well nigh impossible. The use of dynamite is bad. It loosens the coal and offers more fuel for the fire.

Demountable Bodies Will Keep Your Truck Moving

How motor-truck failures became successes when loading and unloading time was reduced

By Joseph Brinker



Lower delivery costs were secured by the use of detachable semi-trailers, loaded while the hauling tractors were on the road

Making the Motor-Truck Pay

In this article, the fifth of the Popular Science Monthly's series on the right way to use the motor-truck, Mr. Brinker takes up the important subject of demountable bodies. Here we learn how demountable bodies have made motor-trucks pay, after they had lost money because they were being used according to old horse-wagon principles.

Efficiency of motor delivery is not to be measured by horse standards. Other important business-building facts must be considered—among them the motor-truck's ability to cover a great territory and to meet emergencies. Sometimes these in themselves justify the purchase of trucks. But the principle of keeping the truck moving, of cutting down loading and unloading time, should, more than any other, govern transportation by truck.

Perhaps there are questions about motor-trucks and their uses that you would like to ask. Send them in. Mr. Brinker will be glad to give you the benefit of his wide knowledge and experience.

AMONG the 900,000-odd motor-trucks now in use there are some that do not save money in comparison with horses, if the cost per unit moved alone is considered. There are countless instances where horses are still employed because the truck apparently cannot compete. So-called short hauls or excessively long loading and unloading times as compared with the time actually spent in motion during the possible working day work in favor of the horse.

The motor-truck is a means of modern highway transport only when its wheels are actually turning. When it is standing idle, when, for example, it is loading or unloading, it is a mere repository for goods, and a most expensive one. Truck operation includes many important factors, but none of greater moment than the method of loading and unloading, for no delivery is complete until the goods are loaded and again unloaded. A truck is losing money when its wheels are not turning. The greater the ratio between the idle standing time and the total possible working time each day, the less is the useful work done. To reduce to a minimum the idle truck standing time during loading and unloading operations, that is an axiom in the correct operation of motor-trucks.

It is because demountable bodies help to reduce idle standing time that they are so important. They may be employed to equal advantage where either package or bulk goods are to be hauled, either between fixed points or on delivery routes. The success of the demountable body is not dependent upon the kind of goods moved, for it has been applied successfully in transporting small packages of groceries or drugs as well as cases of goods weighing one half ton, loads of lumber, bags of mail, rolls of print paper, boxes of fruit, and even five-ton loads of bulk coal.

Wherever the case of the motor-truck seems hopeless because of the conditions of extreme loading and unloading delays under which it must be operated, the applied study of the principle of demountable bodies will in nine cases out of ten make the truck installation not only possible, but highly profitable.

A Saving of $16,500 a Year

Take, for example, the case of a St. Louis grocer. By using five demountable bodies he made three trucks do the same amount of work as five trucks without them. This is equivalent to a saving in truck costs and operation of over $12,000 a year. Besides, his demountable bodies enabled him to do away with the labor of two loaders and one checker and to save $375 a month in wages alone.

The cost of the demountable bodies and the equipment to hoist them was less than $2000. Yet they saved approximately $16,500 a year. This saving was made possible by cutting down the loading time from thirty minutes without demountable bodies to less than ten minutes with them.

As they are loaded with groceries the demountable bodies are suspended in the stockroom from short overhead tracks running perpendicularly to the edge of the loading platform. These act as switch tracks from which the loaded bodies are transferred by means of an overhead moving carriage upon a second set of tracks in front of and parallel to the edge of the loading platform. Thus a body loaded on any one of the five switches may be transferred to the second set of tracks in front of the platform and moved directly over the waiting truck chassis and then deposited upon it.

Short hauls have always been the bane of successful truck operation. Let us see how a Philadelphia publishing company reduced its haulage costs 12 cents a ton on round trips only 1.1 miles in length. We will learn how wonderful are the saving possibilities of the demountable-body idea. This saving is perhaps the most noteworthy in the history of motor-truck installations; for it was made not with one class of goods, but with five dissimilar

classes of loads, including rolls of print paper, bales of waste paper, bags of printed periodicals to be mailed, common case freight, and even bulk coal.

Using two types of demountable bodies, one chassis is able to haul five classes of goods at will. A box or gondola demountable body is used exclusively for coal. The rolls of paper, the bales of waste paper, and the common freight are carried on the permanent platform of the truck chassis. A demountable platform body with movable side stakes is employed to haul the mail-bags of periodicals between the publishing plant and the railroad station, whence they are distributed.

Reducing Traffic Congestion

In this work, more demountable bodies are used than trucks, so that demountable bodies suspended by hoists in front of the loading platform are being loaded while other loaded bodies are being transferred from plant to railroad station and empty bodies from railroad station to plant. The successful operation of this plan necessitated similar equipment for removing the demountable bodies at the railroad station where the jurisdiction for installing such equipment was out of the hands of the company owning the trucks.

Yet the demountable-body plan so reduced vehicular congestion at the railroad station that 28,000 pounds more of outbound mail could be handled daily without additional truck equipment; the railroad was glad to permit the erection of the overhead hoist necessary for the body removals.

This is one of the few cases on record where an outside concern or one not owning or controlling the trucks used in the work, has cooperated to make the demountable-body idea one hundred per cent efficient at both ends of the haul. With a total yearly tonnage hauled of 105,000, this trifling 12 cents a ton saved by the use of electric trucks with demountable bodies, as against horse-wagons without them, has meant a reduction in truck cost alone of $12,600.

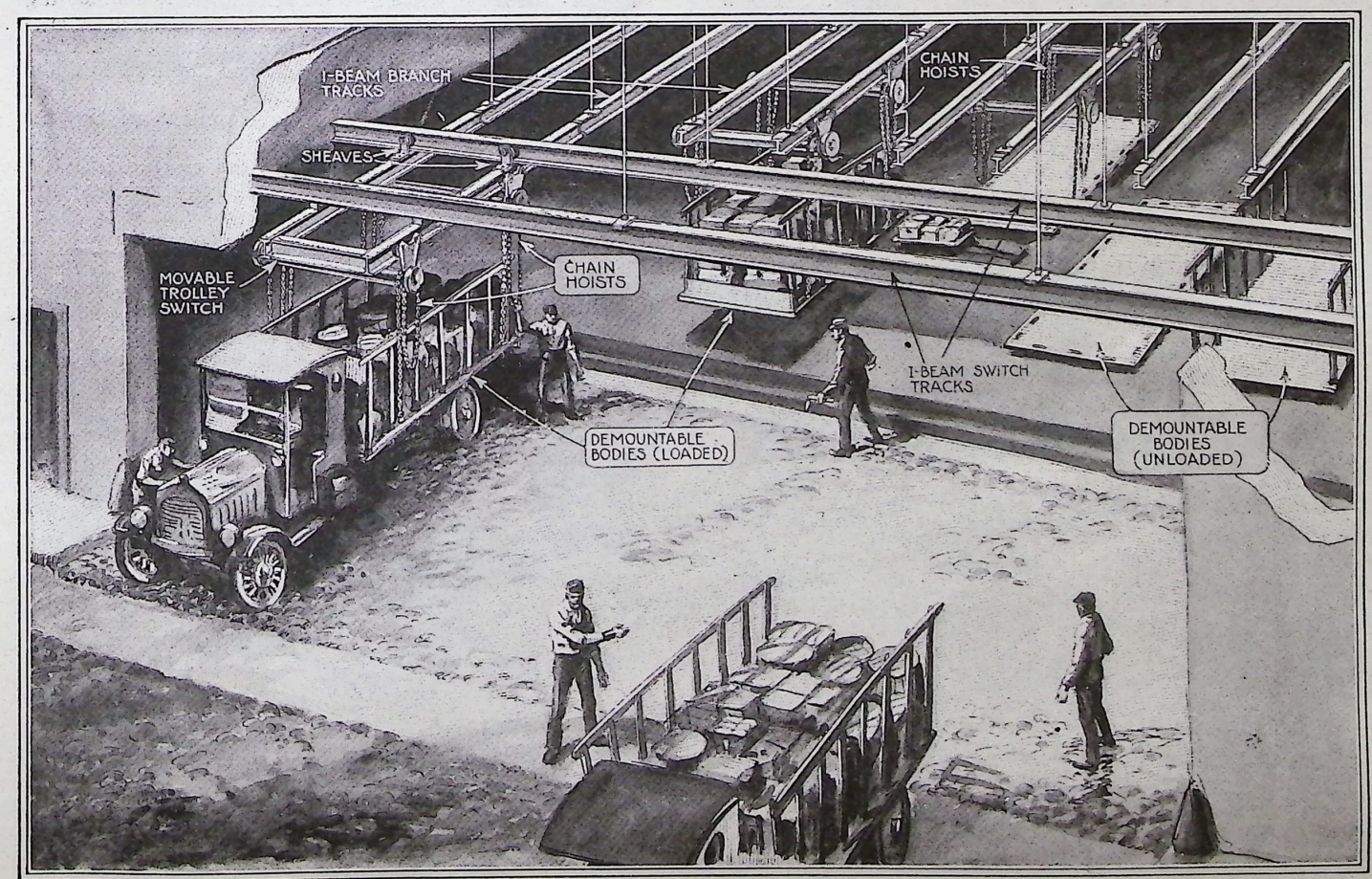
By using the two types of demountable bodies and the fixed platform of the truck as a third type, the trucks are never idle as long as there is work for them to do. When there is no mail to be hauled, the demountable body may be removed and the trucks used for hauling freight, bales of waste paper, or rolls of print paper, which last are removed by means of special electric hoists that can load or unload 9000 pounds in 12 minutes, or less than one third the time required by hand.

When coal is to be moved, the demountable coal body is simply lowered upon the fixed chassis platform; the coal flows down from an overhead hopper and is unloaded by gravity. Both the demountable coal and platform stake-sided bodies are mounted and dismounted from the truck chassis by means of overhead hoists operated by a differential block and falls.

Double Loading Capacity

A wholesale dry-goods company in Baltimore, Maryland, spent $15,000 in a demountable-body installation and saved $22,000 in trucking costs during the first year, in addition to a like amount yearly ever since. In addition to these savings, the fact that the demountable bodies were already installed and in operation when the railroad congestion became acute during the war, made it unnecessary for the company to hire or build a new warehouse which would have cost at least $100,000. The demountable-body investment included thirty demountable bodies and fourteen sets of hoists. The bodies are used in conjunction with eighteen five-ton electric trucks to move the company's goods between its main and subsidiary warehouses.

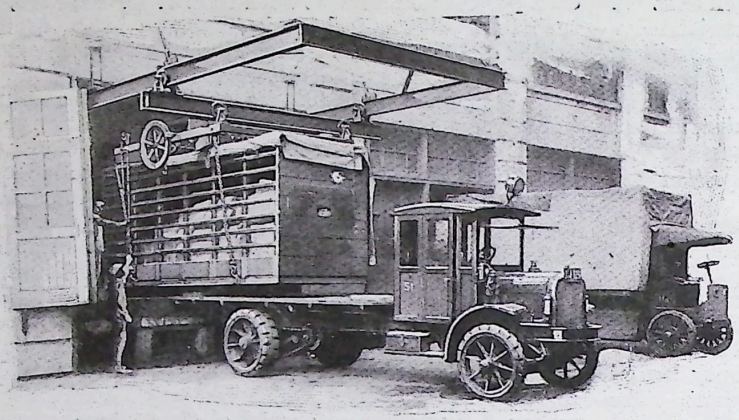
The use of the demountable bodies has practically doubled the work capacity of the trucks with which they are used. Without the demountable bodies each truck averaged about four



Showing the equipment needed for a motor-truck demountable-body installation. This arrangement of overhead tracks for handling demountable bodies enabled a St. Louis grocery firm to save $16,500 a year at an initial expense of less than $2000

and a half loads a day. With the identical truck and a demountable body, the average number of loads a day has been increased to eight and one quarter.

As shown in one of the accompanying illustrations, the method of installing the demountable bodies is just the reverse of the usual procedure; for they are suspended from hoists, so that they are parallel to the edge of the loading platform instead of perpendicular to it. This procedure was followed because it was desired to have all of the loading and unloading performed under cover, and to do this the bodies had to be placed in an alley running through the building from one street to the next. Thus the trucks enter one end of the alley, dispose of their empty bodies, have the loaded bodies placed upon them, and then pass out of the alley in the same general direction as that in which they entered. This reduces congestion in the alley and enables the trucks to change their bodies and begin their next trip within ten minutes.



A manufacturer of paper products reduced the time of loading his five-ton trucks by twenty-five minutes by the use of the demountable body shown here. The bodies are loaded within the building and moved to the waiting truck chassis on an overhead track

Easy Transference of Bodies

The installation is also unusual in that no backing up or maneuvering is necessary for the transference of either the loaded or the empty bodies. The overhead hoists on which the bodies are moved extend clear across the alley. When a truck with an empty body enters, it runs forward beneath one of the free hoists. The empty body is lifted off and moved sideways to the door in front of the loading platform. The truck then moves forward to a point opposite one of the hoists with a loaded body, which is moved sideways over the truck chassis and deposited upon it.

A Brooklyn manufacturer of paper products has reduced the time of loading each of his five-ton trucks from forty-five minutes to twenty minutes by the use of demountable bodies. These bodies are loaded entirely inside of the building; are picked up on an overhead hoist; moved to the loading door and transferred directly upon the truck chassis. At the present time hand-chain hoists are employed to propel the bodies from the point where loaded to the motor-trucks. It is estimated, however, that the loading time can be reduced from twenty minutes to five minutes by the installation of an electric motor to propel the hoists and bodies on their overhead tracks.

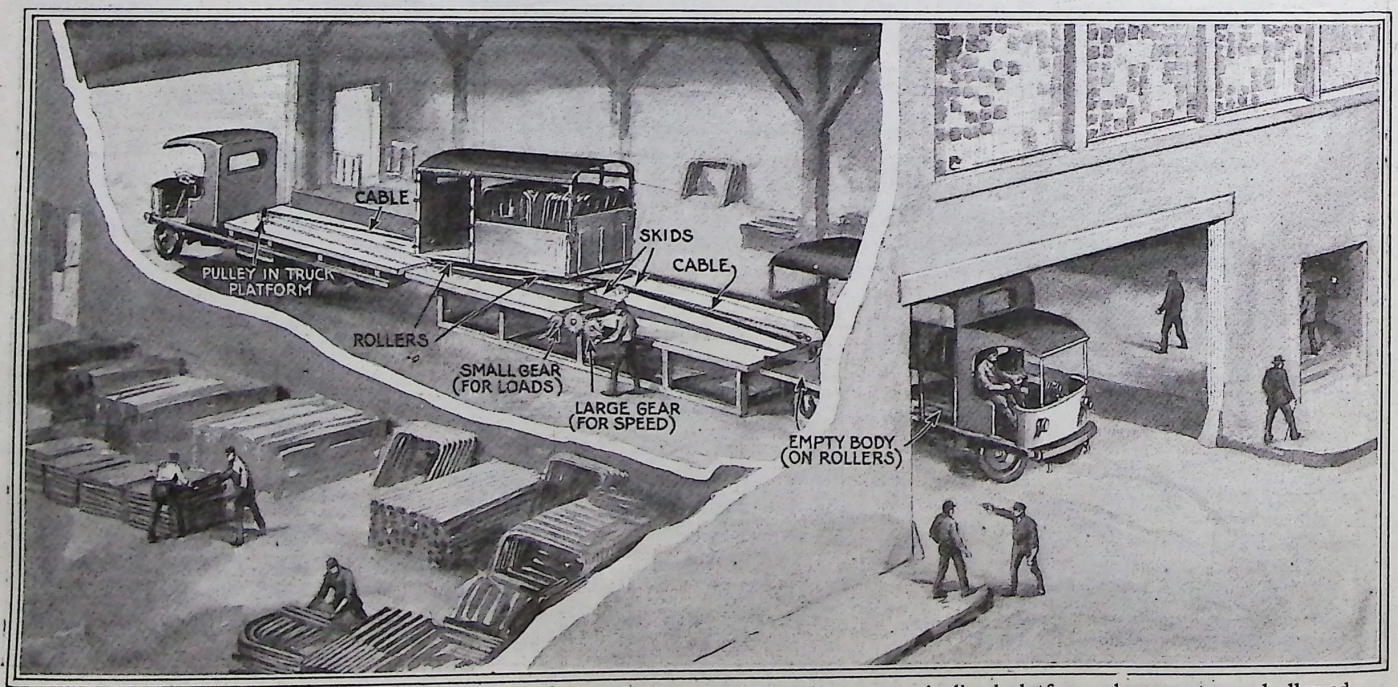
Bodies on Rollers and Nesting Bodies

A grocer in Los Angeles has applied the demountable-body idea in an unusual manner by building the truck body in two parts, each part being mounted on roller casters which permit the truck body to be moved at will around the stockroom while being loaded.

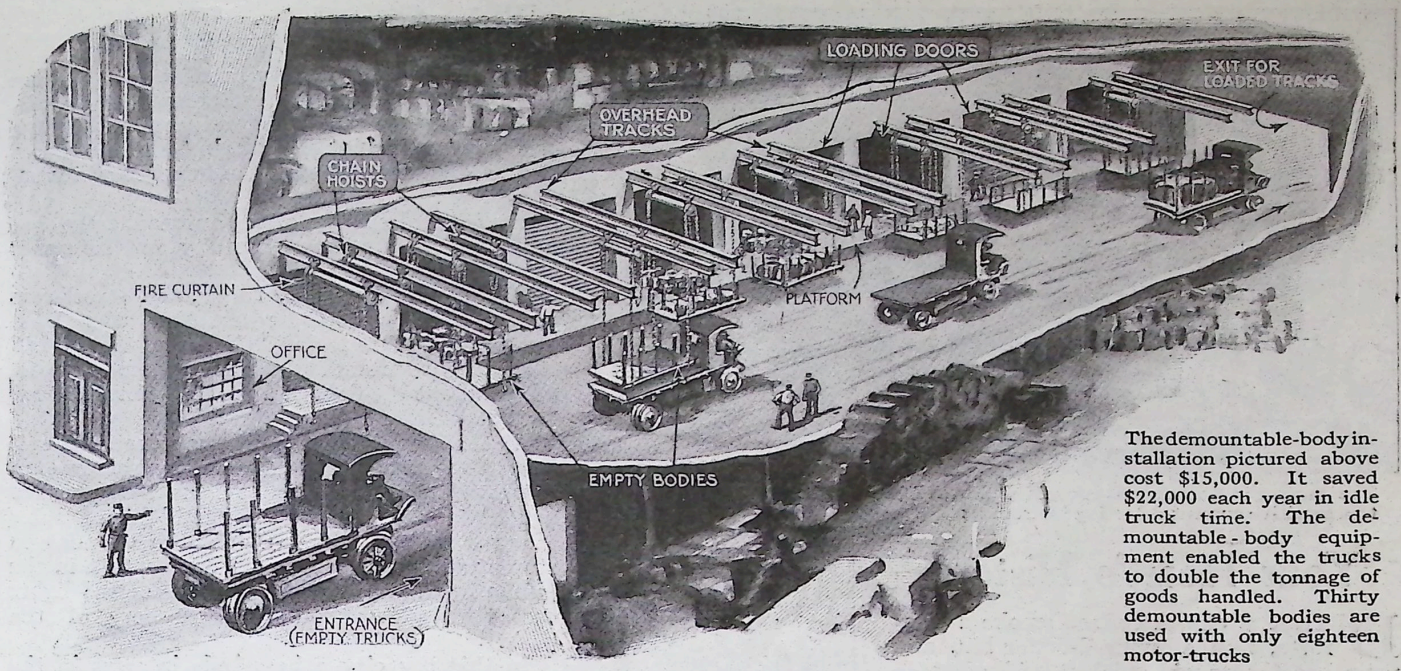
When ready to be transferred to the truck chassis, each body is picked up from the floor by an electric crane which runs on overhead telphers or tracks leading out over the truck chassis at the loading platform. By the use of the electric telpher, all hand movement of the bodies has been eliminated. The truck leaves with its loaded body within five minutes after it has backed up to the loading platform with its empty body.

Before the demountable bodies were employed, it often took a whole hour to load one truck because of the large number of packages required to make up a five-ton load.

A further development of the demountable-body idea appears in the form of nest bodies, which are placed inside of the usual body permanently mounted on the truck chassis. One



How the demountable body, mounted on rollers, is pulled off the truck chassis on to an inclined platform when empty, and allowed, after having been loaded, to roll down the platform by gravity to the truck chassis. Two bodies are used with one truck



The demountable-body installation pictured above cost $15,000. It saved $22,000 each year in idle truck time. The demountable-body equipment enabled the trucks to double the tonnage of goods handled. Thirty demountable bodies are used with only eighteen motor-trucks

good example of such nest-body design is that used by the Arlington Mills in Lawrence, Massachusetts, where skeins of yarn are loaded into wheeled hampers in the spinning-room and then rolled to the edge of the loading platform, where three of them can be placed in the ordinary body of a two-ton truck. This takes but two or three minutes of the truck's time, whereas at least half an hour would be required if the same amount of yarn were loaded by hand into an ordinary body.

Even loads of lumber may be carried successfully in demountable bodies. One lumber company in Neponset, Massachusetts, employs two demountable bodies in connection with each of its trucks. One body is loaded at the lumber-yard, while the other is on the truck making its delivery. The demountable bodies are moved about the yard on horse-wagons for the collection of the loads, and when loaded are moved to two horizontal beams placed on either side of a driveway. Here jacks are employed to lift the beams vertically and remove the bodies from the horse-wagons. The horizontal beams are then jacked up still higher, so that the truck chassis may back directly beneath the body. The body is deposited upon the truck by releasing the jacks.

By this means idle loading time of the lumber truck has been virtually eliminated. Without demountable bodies it took over an hour to load the same amount of lumber.

Drugs also may be transported with success in demountable bodies. One New York drug company employing fifteen demountable bodies in conjunction with ten motor-trucks has been able to handle a three hundred per cent increase in business without the addition of more trucks.

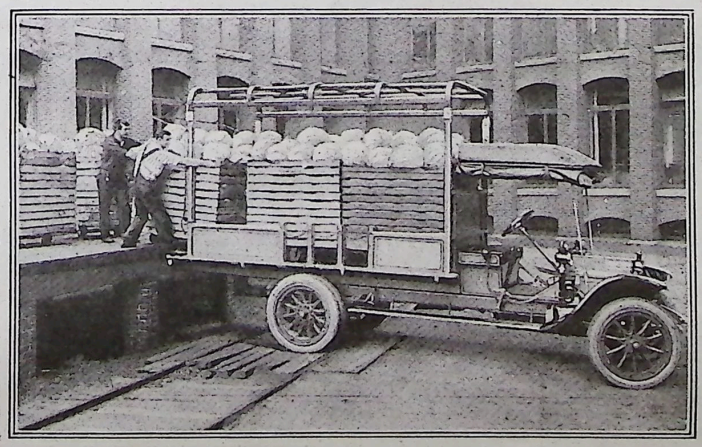
The Demountable Trailer

In still other applications of the fundamental idea, demountable bodies may take the form of trailers which are detached from the hauling tractors when backed up to the loading platform to be loaded. The front ends of the trailers may be supported by means of wooden horses, jacks, or even stands pivoted to the under side of the semi-trailer frame and swung up out of the way when the trailer is connected to the tractor. The use of semi-trailers in this manner permits larger loads to be carried than could be moved on conventional trucks of the same engine horsepower as the tractor.

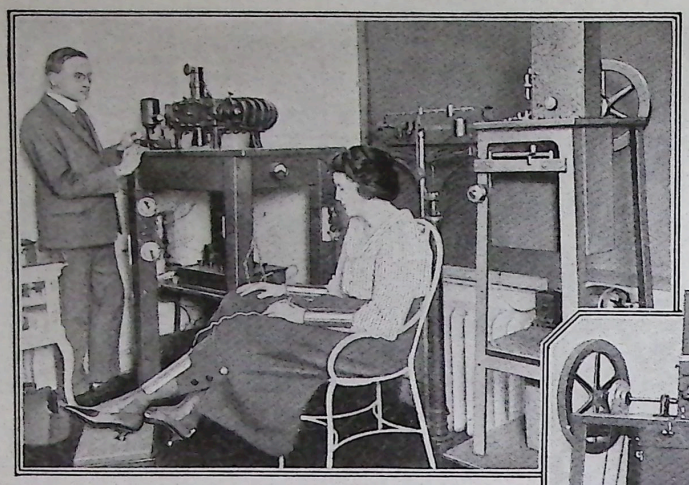
One wholesale grocer, who operates a chain of thirty-nine hundred retail stores, employs at its main plant a fleet of thirty-seven trailers used in conjunction with twenty five-ton tractors. Ordinary trucks proved a failure at first in this work, because it took each one two hours to load. The semi-trailers, loaded in advance, can be coupled to the tractors in eight minutes.

The same idea of demountable semi-trailers has been worked out successfully for the transportation of fruit from the orchards to the packing stations and from the packing stations to the railroads. In one instance, three five-ton trucks and nine six-ton semi-trailers have displaced one hundred and twenty horses in moving the fruit between the orchards and the packing-houses and thence to the railroad shipping-point. Three trailers are used with each tractor, one being loaded at the orchard, one en route, and the third at the packing-house. As soon as a tractor arrives at the packing-house from the orchard, it drops its trailer and returns to the orchard with its empty trailer.

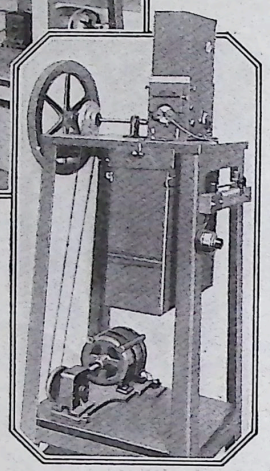
Each trailer is equipped with jacks, mounted on a stand suspended from the trailer frame. When connected with the tractor, the jacks and frame are swung up out of the way. The efficiency of the semi-trailer demountable body is further increased by the use of gravity-roller conveyors for unloading.



In loading skeins of yarn, nest bodies on rollers have reduced the loading-time from one half an hour to three minutes



The patient in the chair is connected electrically to a sensitive current-detecting instrument



The apparatus that records the shadow of the vibrating fiber of quartz upon a moving-picture film

Your Heart's History

DRINK a cup of coffee, smoke a cigarette, find a hundred-dollar bill, and your heartbeats will quicken. All of these irregular actions of the heart can now be recorded upon a moving photographic film by the electrocardiograph. It has been found that the heart, upon contraction of certain of its muscles, generates a small electric current. This current fluctuates with the movement of the heart, and by recording these fluctuations the electrocardiograph will cause this organ to write its autobiography.

The electrocardiograph is one of the most sensitive instruments in the world. When it is properly connected with the human system, no movement of the heart is too small or too weak for it to record. This instrument is capable of laying bare the innermost secrets of that little organ that faithfully pumps blood through our system.

The Einthoven galvanometer is really the "heart" of the electrocardiograph. It is nothing more than a sensitive instrument for the detection of weak electrical impulses.

A fine thread of spun quartz is suspended between the poles of two powerful magnets. When an electric current passes through this fiber of quartz, it will be disturbed, the extent of the disturbance depending upon the strength of the current. If the shadow of the fiber of quartz is cast upon a moving photographic film, every movement of the quartz may be recorded.

By suitable connections with the human body, the minute current generated by the heart may be caused to pass through the quartz fiber of the electrocardiograph and the record is then produced upon the photographic film. The sensitive quartz fiber is faithfully sympathetic to every movement of the heart.

This City Is a Toy

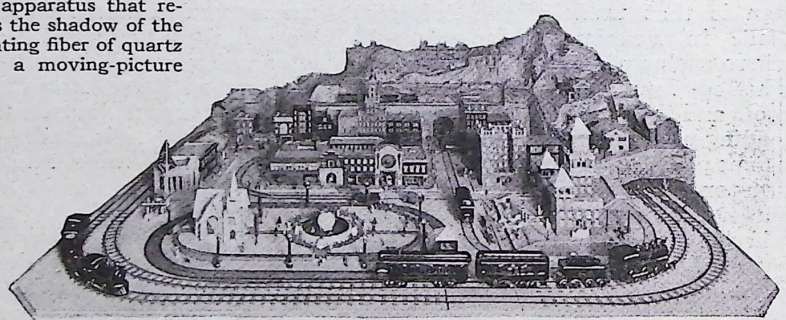
YOU can look down upon a city in miniature and see moving street-cars, automobiles, crowds of people, and all phases of metropolitan life reproduced in a passing show before you. This is not a freak, but an actual toy, which can be used to demonstrate the interesting inventions of the day.

With clever electrical manipulation, automatically controlled, the daylight comes upon the city and its street life begins.

Automobiles, wagons, trains, and street-cars operate; and people, resembling the Lilliputians described in "Gulliver's Travels," move about through the streets. Some of them crowd about the door of a moving-picture show, as true as life itself.

As the day advances and dusk drops its soft light, the illumination of the shop-windows begins, and the city takes on the brilliancy of artificial illumination. The headlights of trains glimmer as they emerge from the tunnel and stop at station platforms. The fountain in the public square begins to play and colored lights cast their glow upon the shrubbery of the park.

In this toy city a boy finds interest in the mechanical equipment of present-day urban life. Perhaps it will influence his whole future.

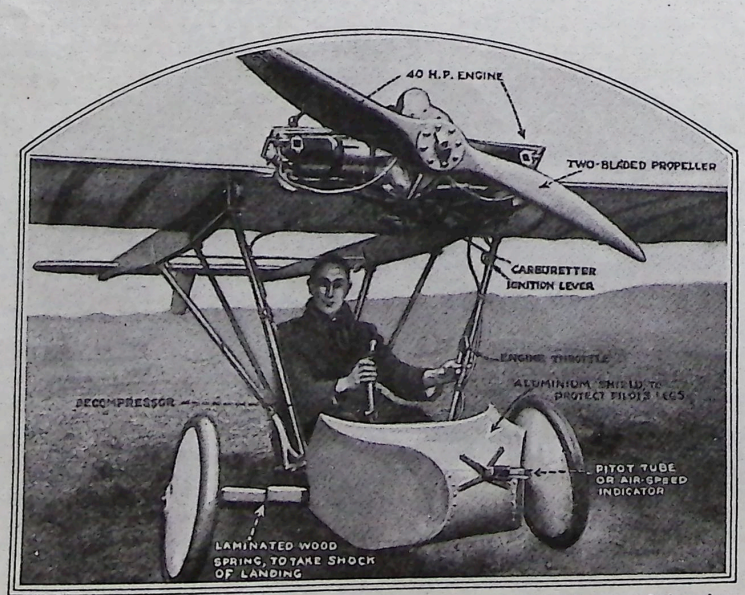


Here is a city unsurpassed by any in "Gulliver's Travels"

As the Crow Flies

THE *Crow* is one of the world's smallest airplanes. It dots the blue sky of England. It can carry you at a speed of sixty-five miles an hour. The *British Crow* weighs 220 pounds and has a wing spread of but sixteen feet. Its motor is a forty-horsepower engine, twin-cylinder, air-cooled, mounted on the front of the plane. It forms, with its mountings and gas-tank, a complete unit that can be easily detached. Mr. Frederick Koolhaven is its designer.

Those who have followed the development of the airplane will find a certain similarity between this machine and the old *Demoiselle* of Santos-Dumont. Like the *Demoiselle*, the *Crow* is probably difficult to control because of the very high center of gravity.



Get in and take a ride with the *British Crow*. This flivver of the air can carry you at the rate of sixty-five miles an hour

This wind-machine can create a seventy-mile gale. It is equipped with a dynamo for use indoors and with a gas-engine for use outdoors

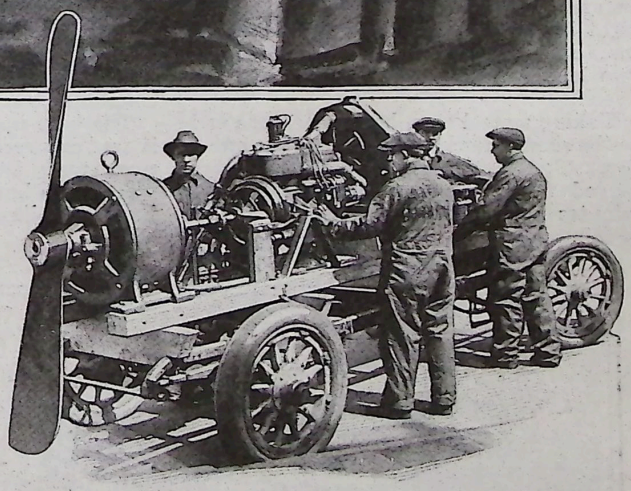
And the Wind Blew

No waiting on weather in the movies

"LOOK at the leaves blowing! What a gale!" You see the tree-limbs bending almost to the ground in the foreground of the screen-picture, not to mention the house being blown down while its occupants are apparently seeking fresh fields and pastures new. The sheets of water blow violently over the top of the portico; the wet shawl around the shoulders of the drenched heroine flaps violently in the wind.

"There must have been a terrible storm when they took that picture!" is the natural conclusion of the audience.

Indeed, no! The day was unusually calm. The moving-picture men might have waited a month for such a storm to fit the scene. And then they couldn't have taken photographs at all. But they didn't wait. They had a wind-wagon that would furnish all the wind necessary.



An airplane propeller, mounted on a movable frame and equipped so that it can be run by either a gas-engine or an electric current, is the wind-machine of the moving-picture studios. It would be most dangerous to make use of a gasoline engine in the studio, where inflammable film is used. So a plug is connected with a two-hundred-and-ten-volt current, and a transformer on the wind-wagon regulates the speed of the dynamo that turns the propeller. It can make four thousand revolutions a minute, creating a seventy-mile gale.

Outdoors a gas-engine is used instead of the dynamo. The wind from this machine is powerful enough to blow down frame buildings.

A Hot Meal on the Spot

BY carrying with him a vest-pocket kitchen, when the noon whistle blows, this mechanic is enabled to set up his stove, light the fire, and in a few minutes have a hot meal ready.

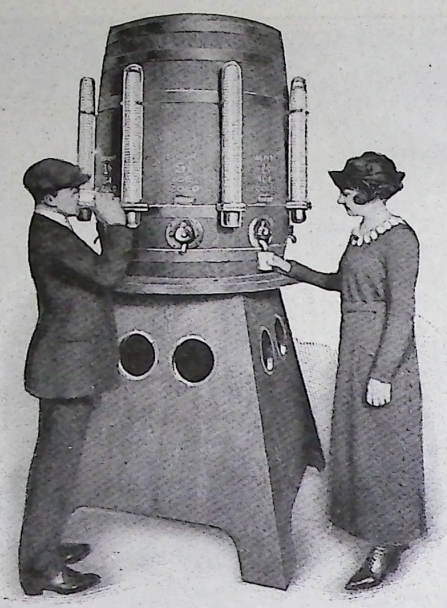
This little kitchen is so efficient that three dishes can be heated at one time—coffee on the lower deck, soup in the middle and beans on top. A few cubes of solidified alcohol in the firebox furnishes the heat.

When the cooking is finished, the oxygen supply is cut off and the fire extinguished. The remainder of the solid alcohol cubes can be saved for use in preparing the next meal.

An Ingenious Homemade Soil-Sifter

THIS electric soil-sifter is used in the greenhouse of the Kansas State Agricultural College. A clever student concocted it from an old motor, two gas-pipes, the framework and wheel of a sewing-machine, and an iron hoop. This material he arranged into the position seen at the right in the picture. Then he placed the hand sifter on the iron hoop supported by two legs. These he bolted to the work-bench.

Taking a steel arm, he fastened one end to the sieve and the other end to the crank bar. The motor was started, the sieve moved from side to side, and in five minutes it thoroughly sifted a bushel of soil.



A Soft-Drink Fountain that Takes Care of Itself

"DROP a nickel in the slot and get a marriage license"—so the nickel-in-the-slot machines of the future may say.

Automatic vending by the slot-machine is growing every day. You can get a shoe-shine, postage-stamps, stationery, soap, towels, drinking-cups, candy, peanuts, gum, newspapers, moving-pictures, and music from vending-machines.

A measured quantity of any kind of soft drink can be obtained from the vending-machine shown in the picture above, which takes the form of a large oak barrel. As many as eight drinks can be drawn at one time.

Each spigot has a supply of sanitary paper cups placed near it, which are made available by inserting one cent in a slot.

The capacity of the oak barrel is sufficient to provide eight hundred people with a cool, refreshing drink before it becomes necessary to refill it.

The base upon which the barrel stands is used as a receptacle to accommodate the used cups. When this drink dispenser is placed in a busy locality, as much as four hundred dollars has been earned by it in a single day.

The Telephone Calls Your Station

IT will be your own fault if you ride past your subway stop when this system comes into use. The guard calls the stop into a telephone transmitter, and his voice is reproduced in the vestibule of each car in the train.

Loud-speaking telephone receivers, used in connection with a special form of amplifier, solve the problem. The voice, loud and articulate, can be heard above the noise of the train.

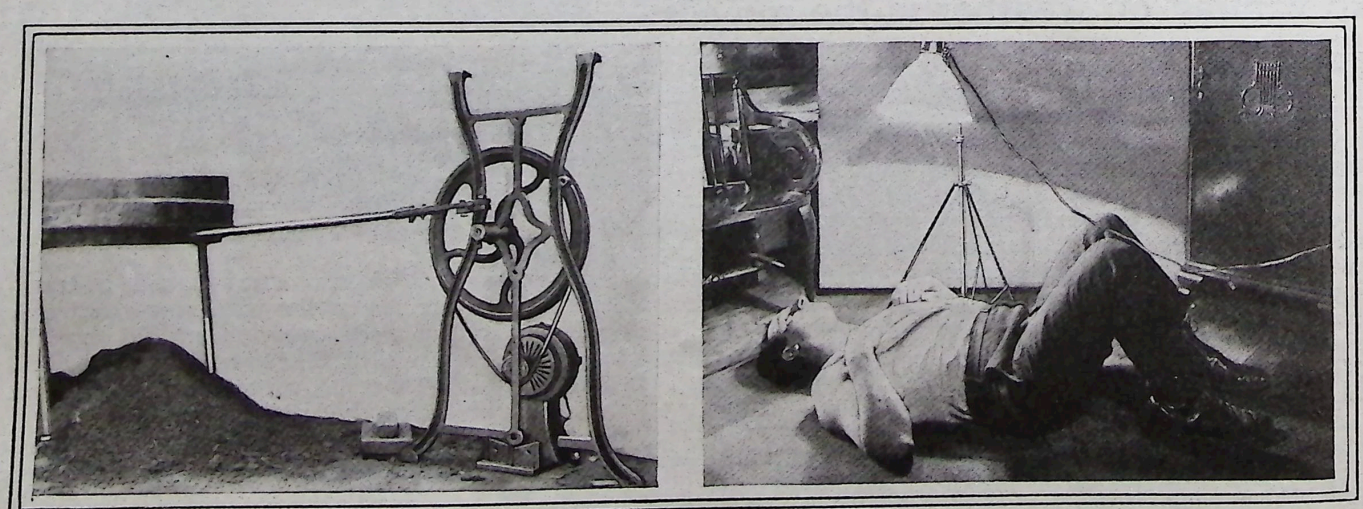
This new development for the comfort of the traveling public is the result of the work of E. E. Trafton, the telephone engineer for the Brooklyn Rapid Transit Company of New York city.

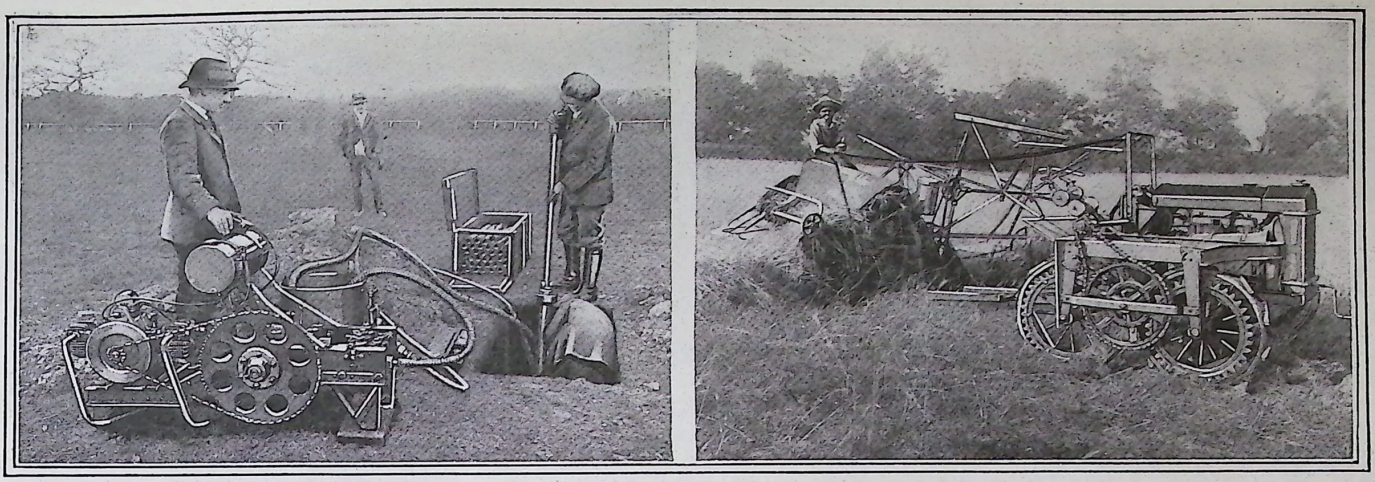
Getting Sunburn without the Help of the Sun

NO longer is it necessary to go to the seashore or country to develop a well tanned skin. It can be done at home—while one sleeps, if preferred. The little blue daylight lamp will produce a sunburn within a few hours. It has been found that the rays from one of these lamps are just as healthful as those from sunlight.

It is the ultra-violet light from the sun that tans skin. Every electric-light filament gives off these rays, but the glass bulb prevents them from escaping. The little lamp shown is provided with a quartz bulb through which the ultra-violet light may pass.

A special reflector concentrates the rays.





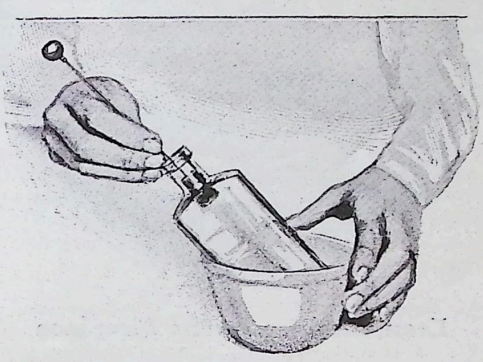
It Will Revolutionize Pipe-Laying

TWO Englishmen, Captain A. R. Mangnall and Captain Irving, have invented a machine that will revolutionize present-day pipe and cable laying.

The portable apparatus weighs only thirteen hundred pounds, and consists of a hydraulic cylinder carried on trunnions in a carriage, and capable of being turned from a horizontal to a vertical position. Inside the cylinder is a piston. This "gun" is dropped on to its framework in the pit, and is connected to a gasoline-driven pump set. The water is in continual circulation. The gun is turned to a vertical position and the "pilot" is dropped into it.

Then the gun is turned down, and, after being alined on position at the next pit, the pilot is thrust into the ground. The admission and exhaust valves are operated by one lever. The gun is again raised, and the first extension piece pressed into it; once more the gun is lowered, and the pilot thrust forward by the extension. This operation is repeated until the boring is completed.

The operation occupies less than one minute.



Rescuing a Drowning Cork

MANY'S the time you've pushed a cork into a bottle when trying to pull it out. Can it be fished out?

Try this: Grease the inside of the bottle's neck with vaseline and hold the bottle under the cold water for a few minutes. Spear the cork with a hatpin and draw it up into the neck of the bottle. Then heat the bottle. The expanding air within will force out the cork.

The Boy and the Binder

IT is no wonder that the eleven-year-old boy in the picture has a broad grin on his face. Farm work to him is as easy as driving a horse and buggy. He sits on a small seat at the rear of a combination tractor and eight-foot wheat-binder, holding a pair of ropes in his hands, and feels that he is lord of all he surveys. By means of the ropes he controls the speed and direction of his machine.

To the uninitiated the binder appears to be a most complicated piece of machinery; but in reality it works as smoothly as the surface of the farm land permits.

Can you imagine any child-labor law in the land being strong enough to prevent farmer's sons helping their father, with such a fascinating farm-tool as this?

Formerly it took two grown men to do the work this boy is able to accomplish with the aid of machinery.

Once again the law of compensation is proved not to be a myth. Farmers are short of laborers, and along comes this machine and eliminates one man's work, or should we say the work of one man and a half?

Another Vacuum-Cleaner Job

VACUUM cleaners will fill pillow-casings with feathers! This kink was discovered by a husband who one day found his wife filling with feathers both a pillow-casing and the workroom.

The husband took an embroidery-ring, placed it over the open end of the casing, attached the casing to the back of the cleaner, and when the cleaner was set in operation over the feathers, it sucked them into the casing.

First Aid to the Wheel

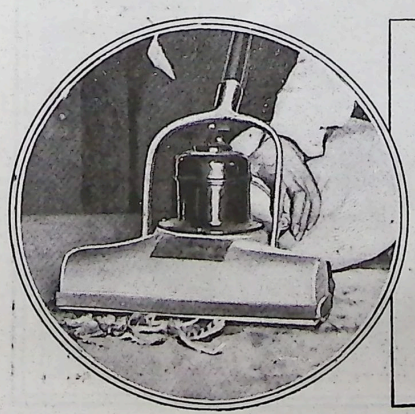
A CHIPPED wheel-flange or a broken axle will hold up a freight-train and perhaps several others. But there has been invented a skid shoe that will enable any train with broken wheels to limp to a siding for repairs.

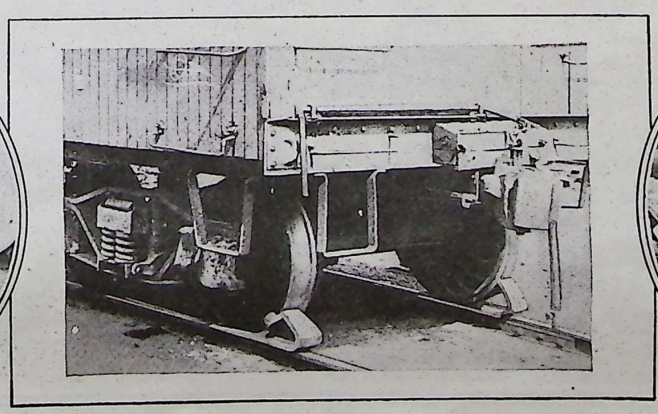
The skid shoe shown below fits in front of the wheel. The shoe will slide along the tracks, and is so made that it will not falter when it reaches either a curve or a switch.

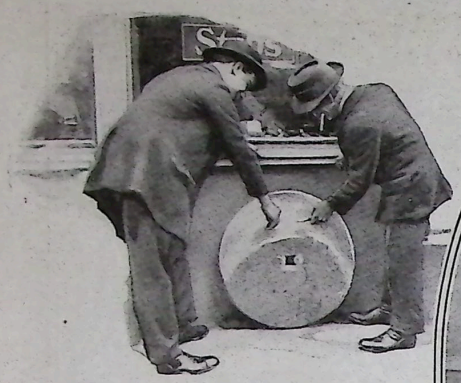
Seeding the Cantaloup

SEEDING cantaloups is an art deftly performed by the natives of the regions in which they grow. The two halves of the melon are turned quickly around a stiff piece of rind, or other suitable object held between them. This motion dislodges the seeds, and they are collected in a vessel for future planting.

Tradition credits this extremely popular fruit with having been imported from Armenia.







The Community Grinder

A GOOD advertising man is this dealer. He sells abrasive materials and he believes in advertising the fact. To do this he has put a large grinding-wheel on the front of his shop where the passers-by can stop and sharpen their pocket-knives.

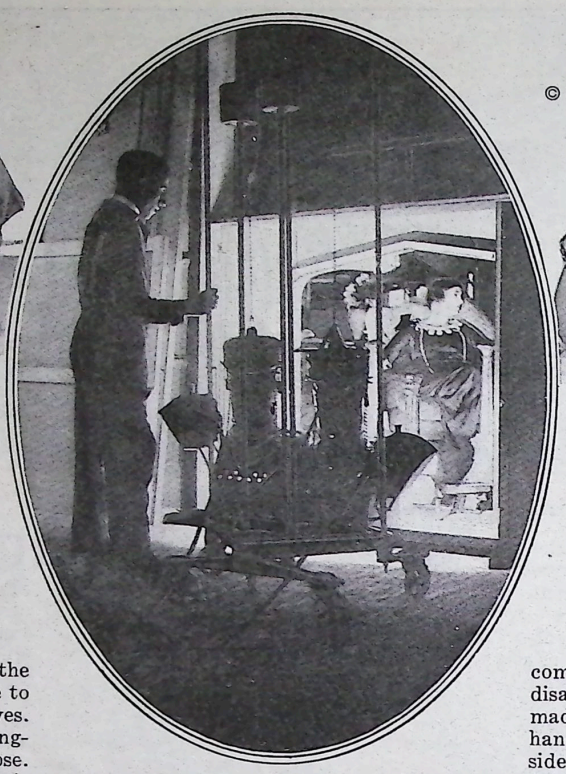
The stone has become so popular that the housekeepers of the neighborhood come to the store to sharpen their kitchen knives. It has become the neighborhood grinding-stone and it serves a very worthy purpose. People gather around it to sharpen their knives and chat, the way they used to gather around the neighborhood pump.

The shopkeeper claims that it has done much to help his business, people frequently recollecting their need of some item displayed in his windows.

Horses Up to Their Hips in Mud

THE horses are not sitting down to take a rest. They are trying very hard to get up. Their hind legs are under the ground, not on it. The potato-field in which the horses were working was very boggy, and, without warning, their hind legs sank. The more they try to get out, the further in they sink. On the whole, though, they don't seem frightened.

The potato bags standing erectly in the foreground will have to wait until the horses are extricated before they will be collected and carried to town. It seems evident that the farmer has gone to get help.



Even the Fire in the Fireplace Is Unreal

THE cheery glow of the fire is quite unable to rouse the listless moving-picture heroine pictured above.

Perhaps it is because that cheery glow is just the concentrated effort of several powerful electric lights operated by an electrician behind the scenes. And the flames that seem to be rising from the logs are really spurts of steam issuing from jets hidden behind the imitation logs. So, of course, there is nothing at all cheery about the fire from the actress's viewpoint. There is little doubt, however, that the audience will enjoy it to the full and wish for one like it, and young couples will make a vow that their new home shall have one.

Whether the interests of science excuse our so mercilessly exposing an illusion of the moving-picture world, is a matter that must be decided by the individual. Privately, we have our doubts.

© Kadel & Herbert

Here's the Parasol-Purse

IN spite of the cool weather, the chief bather in the picture above carries her sunshade with her. But she does not put it between herself and the sun. It is the latest thing in sunshades and must not be left at home.

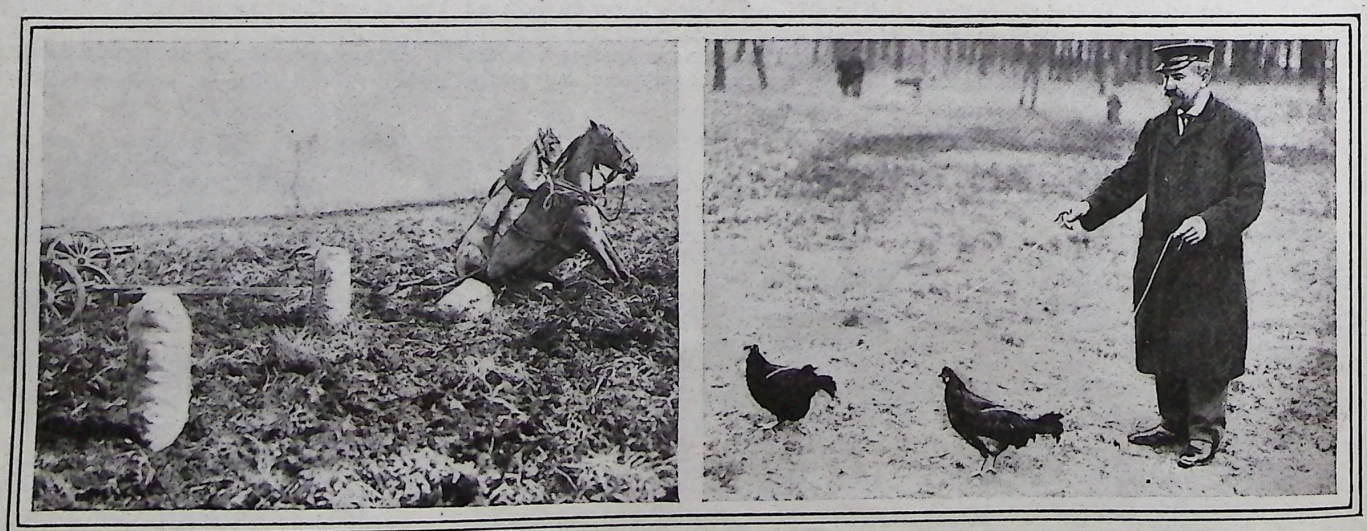
When the sunshade is closed, it becomes a handbag! The umbrella handle disappears discreetly within and the newly made bag is carried by hoops. Half of the handbag may be seen hanging down one side of the umbrella; the other half hangs down the other side. They look like ornaments, but they contain all the young lady's valuables.

What does she do with her precious parasol when she goes into the water? That's easy: she doesn't go in. Why put on pretty clothes just to get them wet?

Hens Out Walking with Their Keeper

HENS are so scarce in Germany that they are never allowed to run around loose any more. They are closely watched and kept in captivity. Every day they are taken out for a walk, but they travel at the end of a string all the time. At night various members of the family to which they belong take turns at playing watchman.

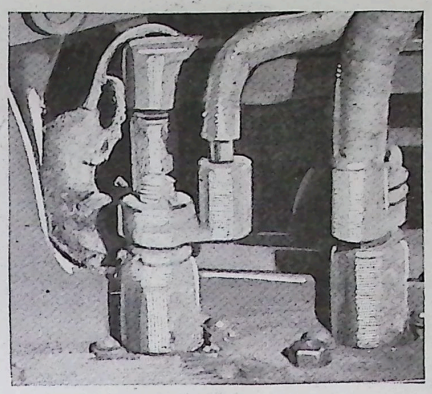
The hens in the picture appear to fully appreciate their new dignity. Their ancient enemy, the dog, has lost the prestige of former days. The birds strut along, not realizing, possibly, that use and not beauty is the reason for their importance.



Painting Traffic Lines

PAINTING traffic lines is a quick and easy job when you use a painting machine like this one. The machine resembles the whitewashing machines used for marking lines on a tennis-court, but its action is entirely different. The paint does not drip upon the pavement. It is fed to a rotating circular brush that distributes it evenly in a narrow strip.

As the brush approaches the narrow opening through which the paint is fed, its bristles are compressed between walls that extend on either side of the opening. The bristles are also bent backward because of the decreased distance from the hub to the opening. At the point of greatest compression the brush reaches the feed opening; whereupon it starts to expand until it reaches its normal size in time to paint the pavement. The action is the same as in hand-painting, and the results are just as smooth. Above a man is painting a traffic line on a street. He travels quickly and will have completed the job in a few minutes.



The Rat that Was Electrocuted by Motor

EVERY little while you hear of a rat jumping off the stairs and breaking its neck or leaping into a pail of water and drowning. Here is the sad case of a rat that electrocuted itself in true Sing Sing style. It stepped unknowingly on the electrical terminals of a high-powered English car, short-circuiting the current through its body.

The driver of the car found it suddenly without juice. He started to hunt the source of the trouble, and came upon the burned body of the rat. The rat must have caused quite an arc when it took the fatal step, for the main switch was also badly burned. At least, this rodent showed good judgment when it picked out one of the most expensive English cars in which to do the deed.

Seriously speaking, the rat has become an electrical pest. Central station men dread it because of its short-circuiting proclivities. It is always stepping in where people fear to tread, even though it is absolutely unfamiliar with the laws of electricity. However, a dead rat is always good for the community at large.

© Kadel & Herbert

Eating the Greedy Camel

AT the present price of grain, a camel is an expensive pet to keep. He will eat three dollars' worth of food a day, whereas a boa constrictor is satisfied with one rabbit a month.

When two exhibitors exchanged pets, the new camel-owner couldn't stand the expense. He sold the camel to a butcher, who cut the animal up and sold him in steak form to hungry customers.

This happened in Paris, where horse meat is not unknown and lion meat brings a fair price.

However, we feel very sorry for the camel. If he had known what was in store for him, he might have dieted.

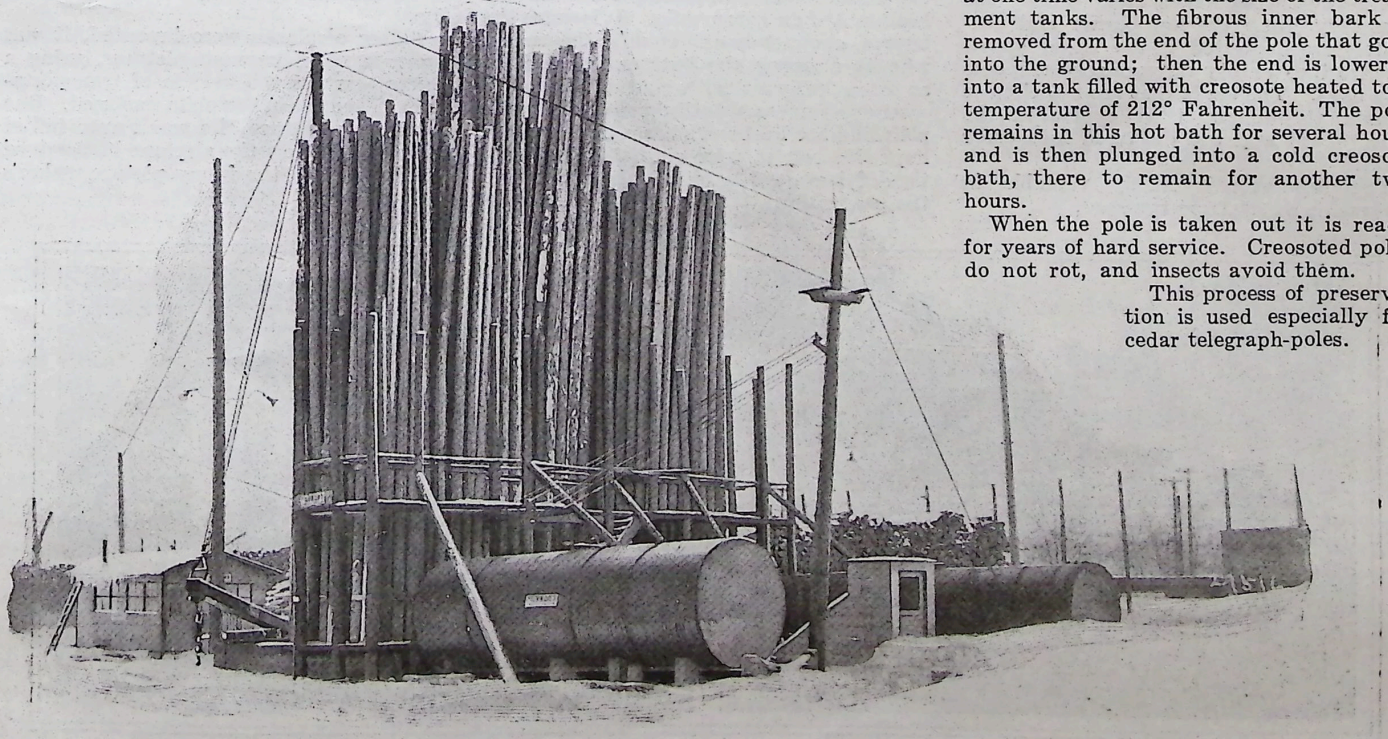
These Telegraph-Poles Are Getting a Creosote Bath

LONGER life for telegraph-poles is made possible by alternating hot and cold baths.

The number of poles that can be treated at one time varies with the size of the treatment tanks. The fibrous inner bark is removed from the end of the pole that goes into the ground; then the end is lowered into a tank filled with creosote heated to a temperature of 212° Fahrenheit. The pole remains in this hot bath for several hours and is then plunged into a cold creosote bath, there to remain for another two hours.

When the pole is taken out it is ready for years of hard service. Creosoted poles do not rot, and insects avoid them.

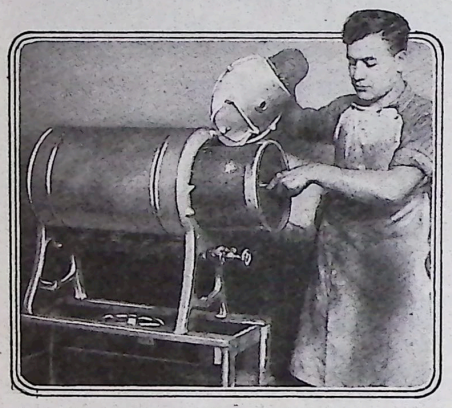
This process of preservation is used especially for cedar telegraph-poles.

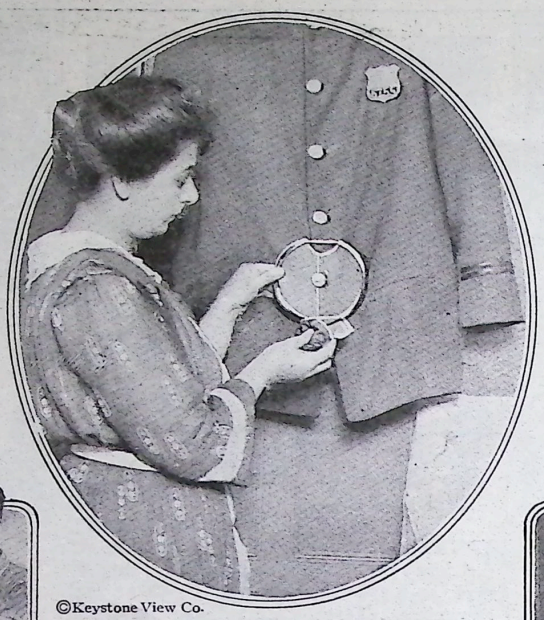


Salted Peanuts Roasted in the Shell

IT is no longer necessary to shell peanuts before they can be salted. They are now soaked in a strong brine, drained, and placed in this special roaster. Before the process of roasting, an air pressure is applied that forces the brine through the fibrous shell of the nut, imparting a delicate flavor to the kernel. This done, the roasting is started and continued in the usual manner.

The little roaster shown in the photograph below has been perfected especially to carry out the new process of making peanuts salty without removing their shells. This serves to keep them clean and fresh.





©Keystone View Co.

When in Need of Coal, Why Not Use Sawdust?

WITH coal at fourteen dollars a ton, the use of sawdust as fuel will interest many people who have to heat homes this winter.

An officer in the British army has invented a small stove that uses sawdust as fuel. He claims that it will keep two rooms comfortably heated in the coldest weather. Its construction is very simple, sheet iron being used throughout.

It is claimed that the stove will burn for twelve hours on one filling of sawdust, which may be obtained at the local lumber-yard for a few cents. Sawdust burns quietly and produces practically no flame.

Separating Seeds by Their Shape

A NOVEL seed-separator divides round seed from those that are egg-shaped, elongated, flat, three-cornered, or whatever shape a seed may be. It consists of two series of spiral channels through which the seeds are passed. The inner spirals are lower than the outer series.

The round seeds attain greater velocity in flowing through their spiral passage, so that they jump the low barrier and ultimately are deposited in the larger spiral, whence they empty through special spouts into bags. The seeds that are not circular remain throughout their course in the inner spiral and are delivered into other sacks.

The separator is chiefly valuable in separating vetch from rye seed.

Polishing Brass Buttons without Injuring the Coat

KNOWING the fascinating power that brass buttons have on the gentler sex, it behooves all officers to make their buttons shine brightly. But how can brass polish be applied to buttons without the risk of getting it on the cloth beneath?

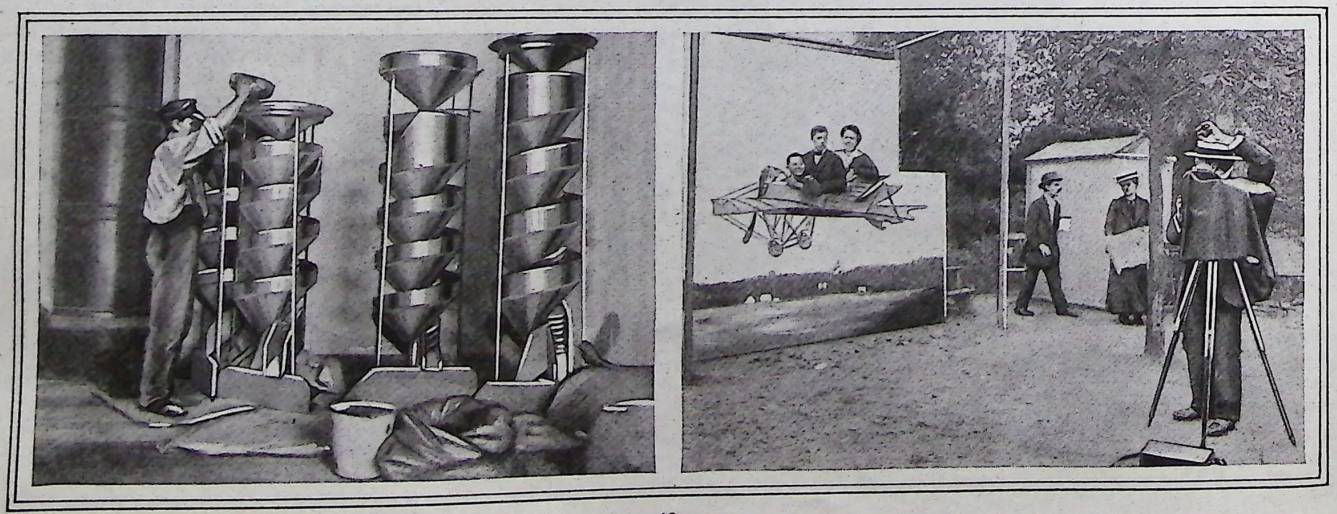
A New York patrolman's wife solved the problem by inventing a glass shield that is placed around the button. The shield is made of two pieces of glass, each semi-circular in shape, which fit together. At the center the glass is grooved to receive the button and at the top it is grooved to make way for a spring adjustment that holds the shield in place. Each semi-circular piece of glass is placed in a metal frame, and the two metal sections are linked together at the bottom and held together at the top by the spring. When the whole shield is in place it looks like the headlight of an automobile. It isolates the button completely and enables the person who is cleaning the button to polish it as strenuously as he would a doorbell.

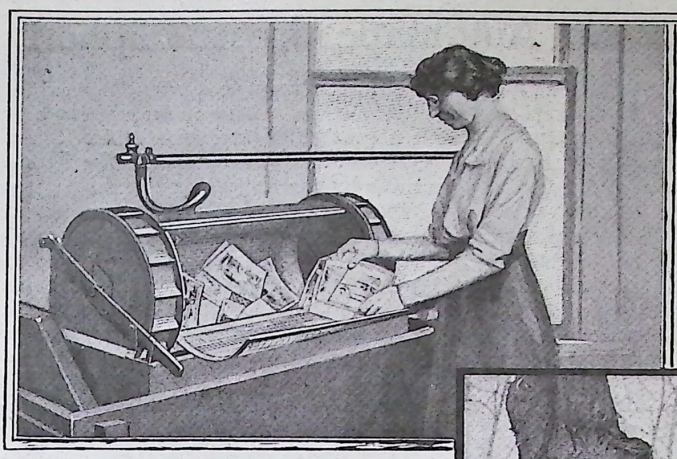
Above you see a dutiful policeman's wife polishing her husband's brass buttons. We hope sincerely that he will not take advantage of her good work and try to dazzle the passers-by.

The Easiest Way to Fly

TAKE a seat in a chair behind the painted airplane shown in the photograph. You will appear to be suspended in the air in flight. To make the picture more humorous, the proportions of passengers and airplane can be disregarded. Thus the photograph will show a large-sized image of yourself and friends and the flying-machine will appear ridiculously small.

Before airplanes were invented, it was common to make such pictures, using a donkey-cart as the vehicle of transportation. Then the automobile was used. One could see a picture of a small auto full of big people. Now the airplane has arrived for its share in the funny picture-maker's art.





Washing Photograph Prints

WHEN a lot of prints are placed in a flat tray to be washed, great care must be taken to prevent them from sticking together in such a way that some are imperfectly cleared of hypo. Here is a device that assures perfect washing, and chapped hands are avoided.

A mesh cylinder of metal is revolved by water-cups on each side, the power being furnished by a hose attached to any faucet. The revolution of the cylinder shuffles the prints and provides a complete washing as they are dipped below the level of the water contained in the lower part of the washer.

When the work is finished, the cylinder can be easily lifted out and the prints removed. At intervals of several days, when dirt has settled in the bottom of the container, the water can be drained off by removing a stopper in the bottom.

This print-washer provides a way to handle numbers of prints without one's hands in the water. When prints are washed with a single stream, it is necessary to shuffle them.

Keep Your Small Metal Fares on a Safety-Pin

SINCE there is no coin between the nickel and the dime, railway companies that have raised their fare to an intermediate amount are constantly troubled with making change. It is not only difficult to obtain enough pennies to go round, but the conductors find their work more complicated.

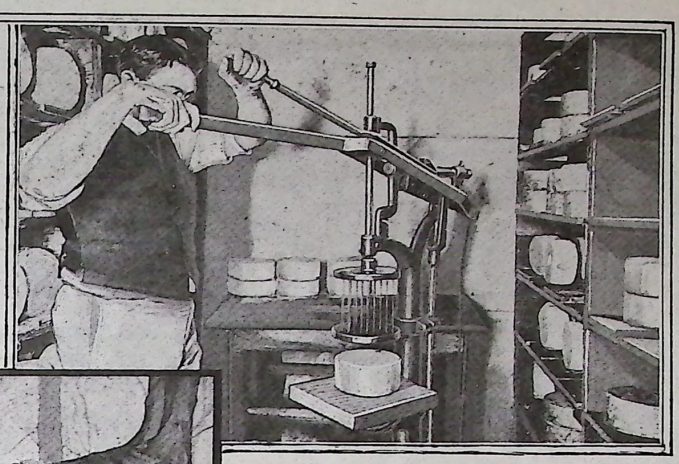
In Aurora, Illinois, the street-railway company has issued a small coin that represents the new eight-cent fare. You buy these coins by the dozen at a ticket-office. They are, however, very small, and you are liable to lose them if you carry them loose in your pocket. But since they are perforated, you can pick them up on a safety-pin, just as a woman picks up her stitches in knitting. An ordinary safety-pin will hold twenty coins comfortably.

In the picture you see the coins on a pin. Each coin has an A plainly outlined on it. A in this case stands for Aurora. This is a suggestion that grocery and dry-goods stores might follow.

A Maple-Tree that Braced Itself

TREE surgeons sometimes find it necessary to brace branches together with bolts and chains to give them strength to withstand the ravages of storms. It is unusual to find a tree that performs this feat itself. The illustration shows a red maple in which two separate branches grew into one, forming a natural brace.

When the tree was young, two branches were sent out from the trunk at different angles. The wind rubbed these branches together, wearing away the bark until the growing inner layers were exposed. The two branches then grew together, forming a natural graft. Later the end of the upper branch died and the two became one.



Making Roquefort Cheese

ALMOST every one likes cheese—especially good sharp cheese. Roquefort cheese is a delicacy that has heretofore been manufactured only in parts of Europe where it was asserted the proper conditions for ripening existed. It was also asserted that goat's milk was necessary for its manufacture.

American scientists have disproved both of these contentions. Roquefort cheese has been successfully made in this country. Not content with making it in this climate, our scientists proved that goat's milk was unnecessary. Cow's milk will produce excellent cheese if it is properly ripened.

It has been found that a room with controlled temperature, moisture, and air circulation is a good place to cure this particular brand of cheese. Before it is placed in the curing-room, it must be perforated to permit air to circulate through it. This brings about a more rapid growth of mold, and more mold, better cheese.

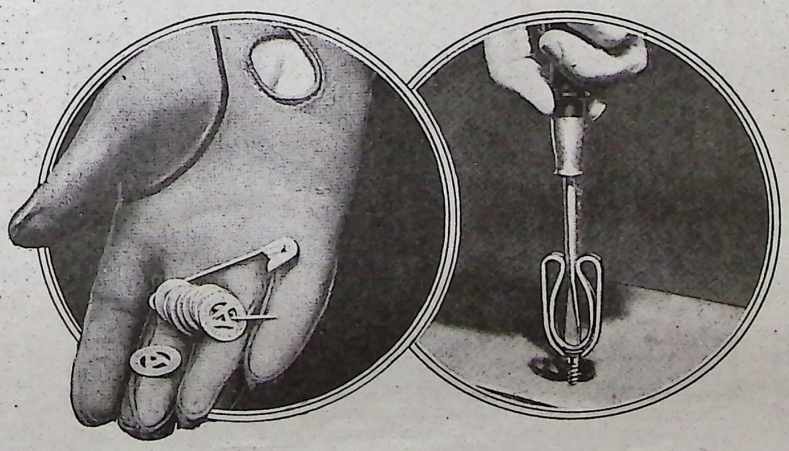
As the cheese grows old, the holes gradually close up.

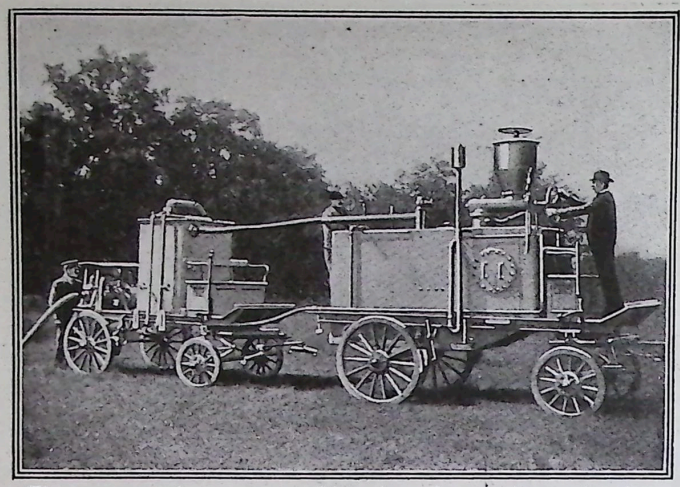
Let the Screwdriver Hold the Screw

EXPERT workmen can practically complete the operation of driving a screw with one hand. Most amateurs need both hands and even then they do not get the screw in straight. For the benefit of amateurs and those who have but one arm the new screwdriver has been invented.

As you see, the driving end has a curved metal attachment. Its job is to hold the screw in the proper position for the beginning of the drive. The attachment is so curved that it is of double thickness at the bottom. The lower section is open so that the head of the screw can be inserted. The upper section has a hole in it through which the screwdriver can revolve. Both the driver and the screw are in the same straight line and it is impossible to send the screw in crookedly if you hold the driver in a perpendicular position.

The arms that grasp the head of the screw are curved to fit it and are adjusted to hold it firmly. You must spread them in order to release the head.





The apparatus has two separable units. One truck contains the hydrogen generator. The other truck mounts an engine

A Balloon Hydrogen-Generator that Goes on Wheels

HYDROGEN is extensively used for filling balloons as well as for other scientific and commercial purposes. It is true that helium, being incombustible and inexplosible, offers a distinct advantage over hydrogen, but it is a great deal more expensive and difficult to obtain in large quantities.

In many cases the hydrogen is generated a long way from the place where it is to be used, and so it must be transported to that place, compressed in steel cylinders. But this method also is expensive, and is besides accompanied with great risk.

Long before the war, apparatus was invented to generate hydrogen on the spot.

A new design of portable generator is mounted on a truck. The hydrogen is generated by the action of a metallic substance like silicium on a hot solution of sodium hydroxide in water. Another truck mounts an engine driven by a pump which supplies the generator with water and is used only in cases where no direct supply is available and the water has to be pumped from a river or pond.

The gas is cooled and purified by passing it through water; it is delivered with a purity of ninety-nine per cent, free from poisonous substances and admixtures. The temperature reached in the reaction is 110° Centigrade, and the apparatus functions without refilling for a period of fifty or sixty minutes.

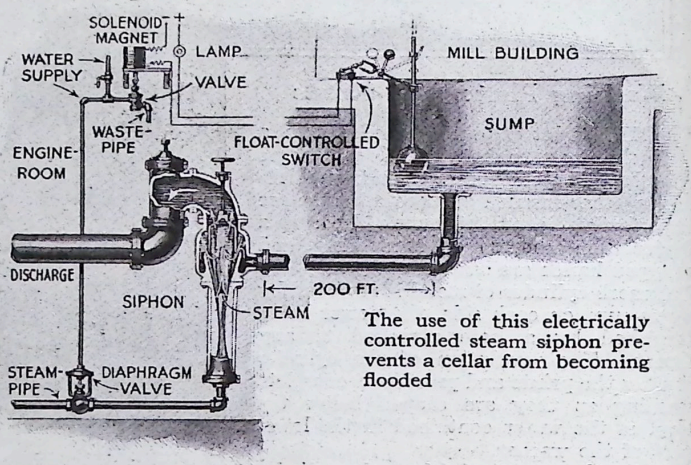
No fire for heating the apparatus is necessary, and therefore there is practically no danger of ignition or explosion of the gas in case of a collision.

The apparatus, which requires three men for its operation, begins to supply hydrogen a few minutes after the starting of operations.

An Automatic Steam Siphon

A SUMP hole in a mill building was drained by a siphon located in the engine-room. The engineer was a forgetful chap and often neglected to stop the siphon. As a result, the basement of the mill was continually flooded. The trouble was overcome by making an automatic system.

A float was placed in the sump. When the water rose to a certain point a switch closed a circuit containing an electric solenoid. The solenoid opened a valve on a small water-supply pipe which caused water to flow into a diaphragm valve controlling the steam passing through the siphon. In this way the steam supply to the siphon was cut off and a flooded cellar prevented.



The use of this electrically controlled steam siphon prevents a cellar from becoming flooded

Enter, the Movable Electric Furnace

CHINA that is not hand painted—how does it get its pattern? In an oven, we find; the pattern is baked on. An electric furnace that can be used for this purpose is shown herewith. It is small, but very strongly built. The oven is mounted on steel casing, and its walls and door are thoroughly insulated, thus preventing loss of heat from radiation.

Mounted directly above the oven are the switches that control the heating. There is a main-line switch, a double throw switch for high and low heat, and a red pilot light that acts as a warning to the operator when the furnace is on high heat. After the switch is thrown on, maximum heat can be reached in an hour and three quarters, and a very even distribution is maintained at all times.

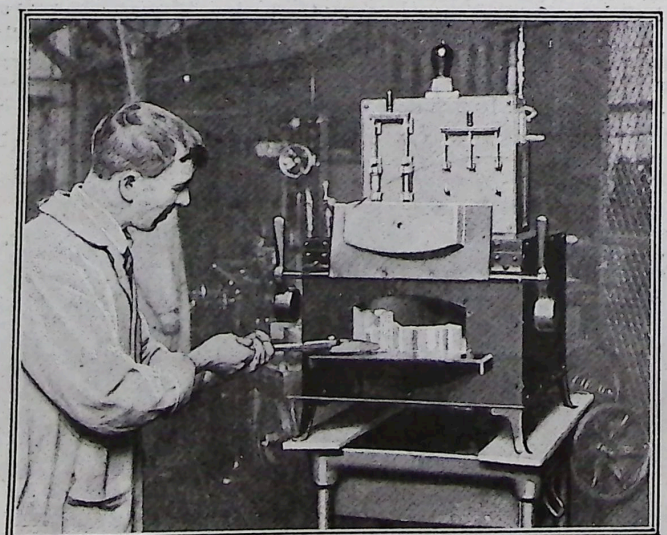
There are connections at the side of the control-board for attaching resistance-boxes when temperatures as low as 300° Centigrade are required.

The furnace can be used for any number of things—for example, heating carbon steel in tool making, baking vitreous enamel, and hardening and tempering tools and dies. It is very easily operated; there is a shelf in front for the convenience of the operator, and the door is equipped with counterweights to keep it in position when opened.

Apart from the advantage of size, this oven has other qualities. It has eliminated the fumes, noise, and smoke of the old-time furnace, and also its numerous gas-pipes.

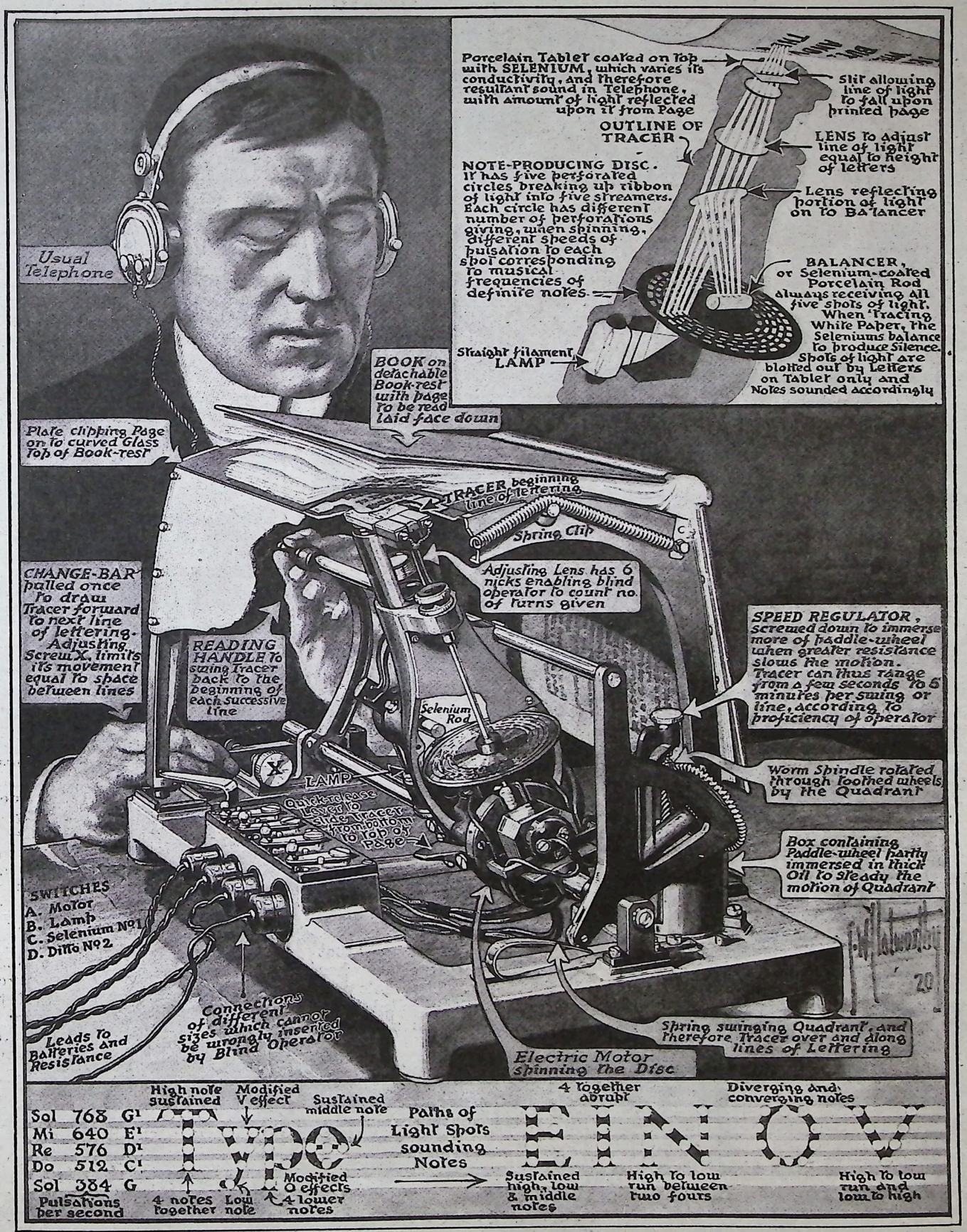
The use of the pilot light largely eliminates damage to the material that is being baked.

It is perfectly safe to go away and look after other business, if the oven is left at low heat.



This movable electric furnace may be small, but it can harden and temper tools, bake vitreous enamel, and heat carbon steel

How the Blind May Read with Their Ears



© Popular Science Monthly

Drawing by S. W. Clatworthy

THE optophone enables blind people to read directly from printed matter. It was invented by E. Fournier d'Albe.

A thin beam of light is projected upon a letter of a word to be read. This beam is broken into five smaller beams by a revolving perforated disk, which also interrupts the individual beams. The beams are interrupted with various frequencies to correspond with five musical notes. The optophone makes it possible to hear the interruptions. This is accomplished with a selenium cell.

Selenium possesses the peculiar property of changing its electrical resistance under the influence of light. The five light beams are reflected from the printed letter to a selenium cell which results in interruptions in an electrical circuit containing a pair of telephone receivers placed over the reader's ears. When the light beams strike a letter, some will be reflected to the selenium. The various combinations formed depend entirely upon the letter's shape. This changes the sound heard in the receivers. Each letter produces a different sound, so there will be as many sounds as there are letters in the alphabet

An aged vessel is filled with cement and sunk to form part of a breakwater

Converting Old War-ships into Breakwaters

"GIVE us the old discarded battleships," say the people who live in the coast cities of England. Why do they want them? Of what use is a ship whose days as a fighter are past?

From the war-ships that are no longer serviceable on the sea, all of the equipment is removed that might be still of service. The hulls of the ships, filled with stones and concrete, are then towed to points along the coast where breakwaters are needed, and sunk. Thus the discarded war-ship forms an efficient breakwater. A vessel such as the obsolete *Prince George*, after twenty-five years of usefulness, will continue to guard the coast, but in this new capacity.

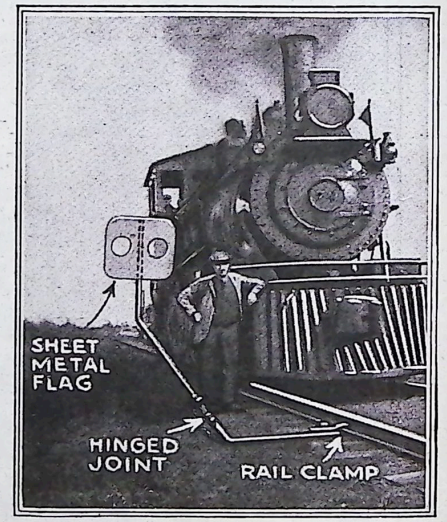
The ship will make a breakwater 390 feet long.

The Flag that Never Wavers in the Wind

RAILROAD accidents are usually due to improper signaling —flagging, for instance. The flag is often mounted on a stick thrust into the ground beside the tracks. The wind blows it down, and the engineer is unwarned.

Alexander Currie, of Sorel, Canada, has invented a flagging signal that can't possibly go astray. It consists of a metal rod mounted on a base that can be clamped securely to any track. The rod is made in two telescoping sections. The metal flag is bolted to the top of the rod and is at right angles to the track.

The whole signal can be packed, carried to the track, and set up in a very short time.



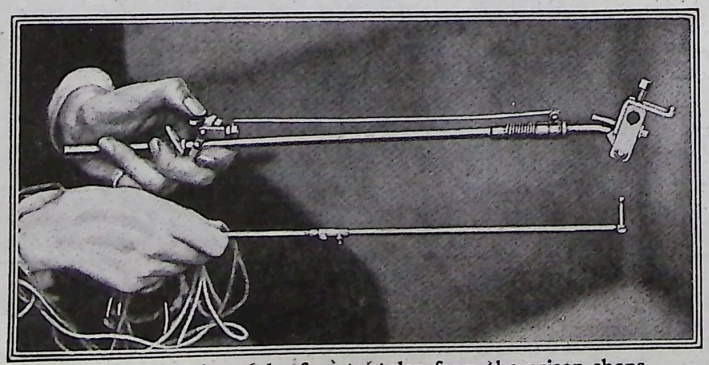
No accidents due to false signals can happen when this new signal is used

Tools that Released Men from Prison

THREE desperate criminals escaped from the Charlestown State Prison at Boston, a few months ago, by means of an ingenious contrivance that they had manufactured in the prison shops.

One of the escaping prisoners was a mulatto, and it was afterward discovered that this man possessed an almost diabolical cleverness in the handling of tools. It was he who manufactured the apparatus pictured on this page, which unlocked a cell door the lock of which was out of reach of the tallest prisoner. This mechanical device is regarded by prison officials as the height of ingenuity. It was an improvised piece of mechanism made up of more than a score of parts, and perfectly put together.

Its body is a rod an inch in diameter and one and a half feet long. The "head" contained a loose part, semicircular in shape, through which was a neatly carved groove. Into the groove projected a screw that was used to keep secure a key when placed in the groove. The whole part at the "head" was controlled by a piston at whose end was a thumb-presser. One press allowed the part to revolve.



The contrivance, made of parts stolen from the prison shops, that unlocked a cell door and released three desperate prisoners

The device was unquestionably of prison make, many of the parts being recognized as coming from various workshops in the prison.

A trusty aided the three convicts in making a getaway.

Cleverly arranged dummies were left by each man on their cots, so that guards passing their cells would suspect nothing even though the convicts were then making their escape.

The police officials declare that there isn't an institution in the world, or an organization within an institution that is infallible in preventing the escape of such men as these. Not one of the men has ever been captured.

The Automobile with a Rotary Valve

It will eliminate all valve-grinding and many valve troubles

By Stanley Yale Beach

WHEN casting about for something interesting with which to busy himself after perfecting his process of acetylene welding, Mr. Eugene Bournonville, a Belgian, conceived the idea of using rotary valves on automobile engines. At the time, James W. Tygard was the only one, so far as the writer is aware, who had successfully applied a valve of this type to a gasoline engine, and he used a special tapered valve in a freak motor. Bournonville set out to produce a valve that could be used on any standard automobile engine.

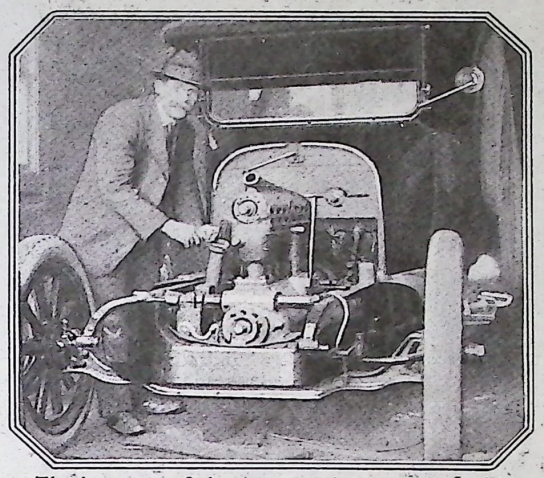
Because of his knowledge of the action of metals under different degrees of heat, Bournonville possessed a distinct advantage over others working in the same line. He used a single valve extending across the top of his four-cylinder motor, instead of individual tapered valves such as had been used before, but the problems of attaining gas tightness and of lubrication of this long straight valve were by no means easy to solve.

To carry off the heat as much as possible, Bournonville used a tubular valve and passed the cold gas from the carburetor through it from the middle to each end. There it made a turn and entered the intake manifold or passage in the water-cooled valve-casing. The exhaust ports were on the opposite side of the casing, and ports in the cylinder heads were connected with the intake or exhaust ports at the proper times by means of cut-away portions of the periphery of the valve.

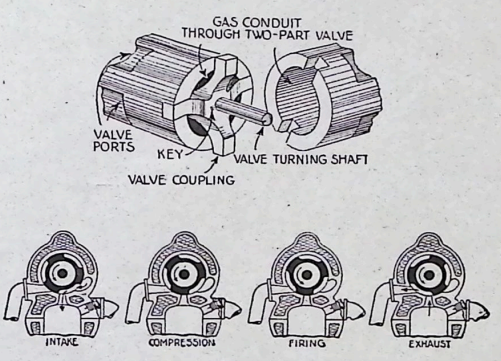
Instead of a camshaft with cams that lift as many as four valves to the cylinder in ordinary modern motors (the two exhaust valves being raised against the very considerable pressure of the burning gases and thereby absorbing power), we have here simple rotary motion with instant and full opening and closing right in the center of the hemispherical cylinder heads. The result is a full charge and complete evacuation of the burned gases. Thus the motor always gives the maximum efficiency — the most power, the highest speed, and the greatest number of miles to a gallon of gasoline that it is possible to obtain.

Because of its great flexibility, a six-cylinder motor is practically vibrationless and as smooth-running as a "twin six," and a four-cylinder quite as good as an ordinary six. The numerous valves of an ordinary multiple-cylinder engine are displaced by but two rotary valves, and these never have to be ground or adjusted in any way. Valve trouble is thereby eliminated entirely.

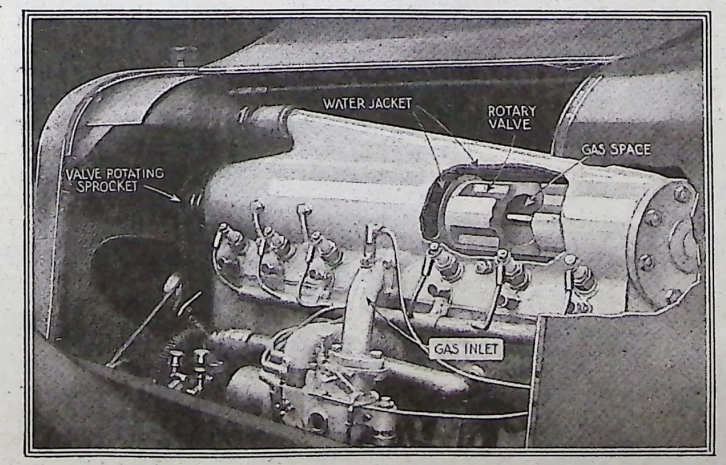
A very reliable air-cooled motor is all that is needed to make aviation as great a sport and business as is automobiling, and such a motor will soon be developed from the air-cooled automobile engine. Because of its internal cooling from the cold gas, the Bournonville rotary valve is peculiarly adapted to air-cooling. Even a water-cooled motor runs much cooler with this valve. The engine pulls at slow speed when climbing a hill, with much the same strength and tenacity exhibited by a steam-engine. The spark can be advanced fully at any time without stalling the engine or causing it even to "knock." Its performance in this regard is remarkable and unexplained.



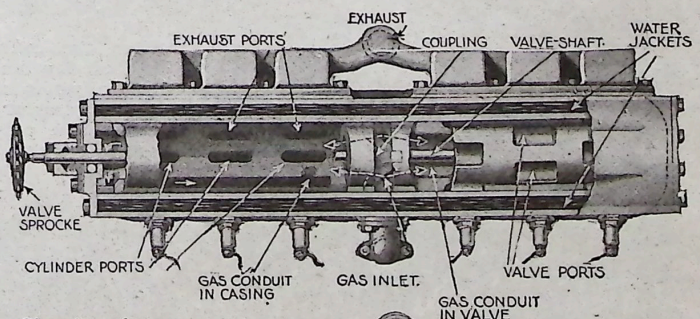
The inventor of the rotary valve at work on his own automobile, which is equipped with one. Mr. Bournonville is demonstrating that the valve can be removed and replaced in a few minutes

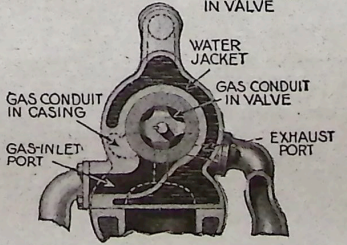


The detail at the top shows how the valve is turned. The various positions of the valve at the time of intake, compression, firing, and exhaust are made clear. Notice the water jacket around the rotary valve. The arrow indicates the direction in which the valve turns



The valve installed on a remodeled engine of a Chalmers car with explanatory details of installation

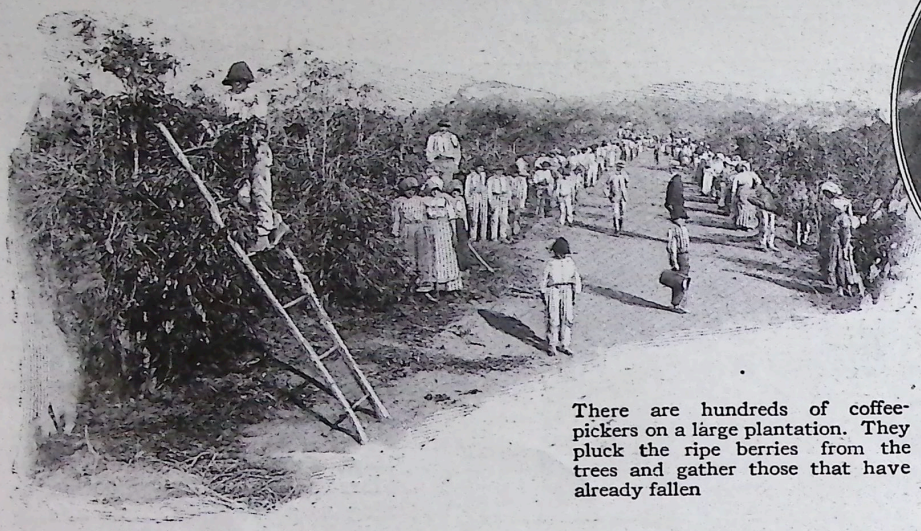




Showing the operation and construction of the new rotary valve. At one side the long, slot-shaped ports are shown. The opposite end displays the corresponding depressions in the face of the valve

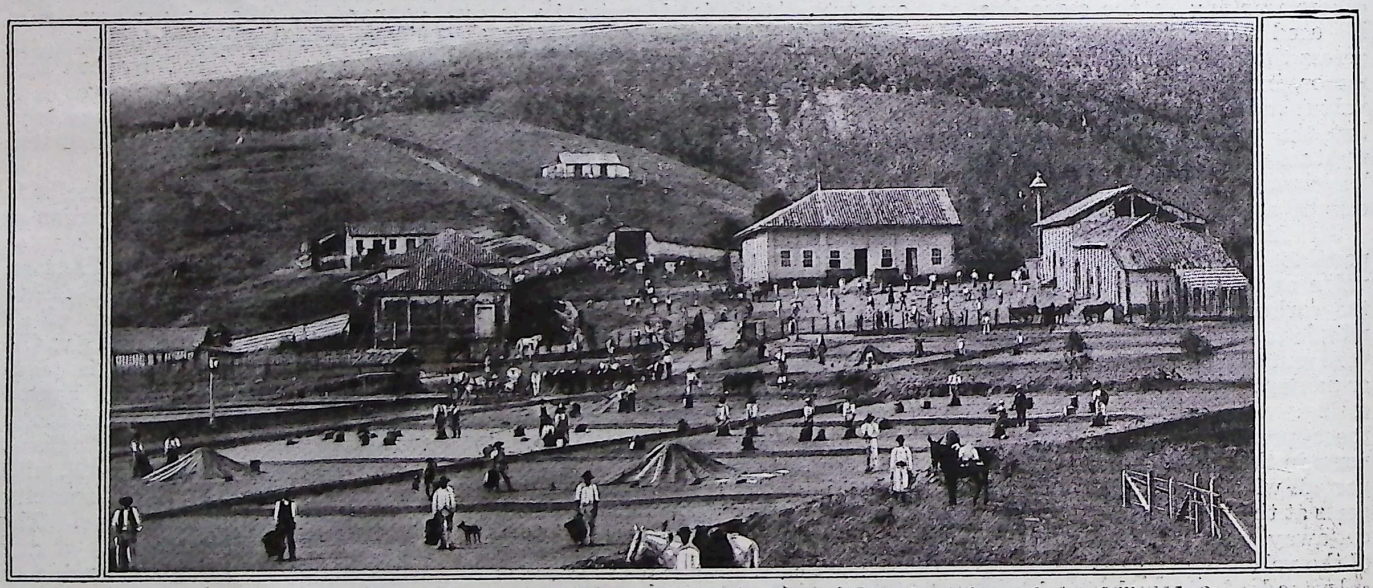
Gathering the Morning Coffee

Long before you drink it



There are hundreds of coffee-pickers on a large plantation. They pluck the ripe berries from the trees and gather those that have already fallen

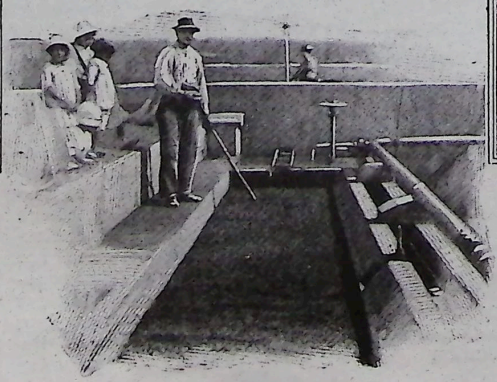
These are ripe coffee-berries ready to be plucked. Two seeds, or beans, are found in the yellowish pulp inside each berry. Two methods are generally used in Brazil for removing the seeds—the drying method and the washing method

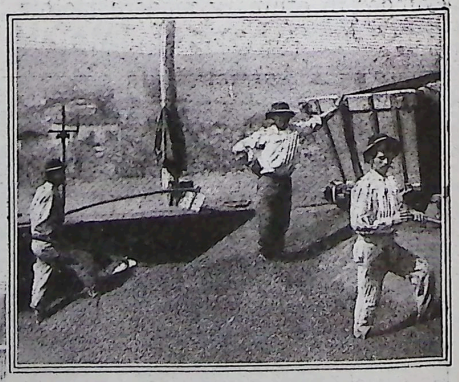


At night the drying berries are swept into piles and covered to prevent the night moisture from spoiling the day work of the sun. When the berries are thoroughly dried, the hard beans within are easily removed

The berries are laid out on drying-flats, and natives constantly stir them with brooms so that they will be thoroughly dried. Don't mind the bare feet—the beans are still inside the berries

After the coffee-berries have been mashed, they are dropped into a second tank of water, where a steady stream soon separates the pulp from the seeds. The pulp floats off, and the seeds, or beans, settle to the bottom





The washing method removes skin and pulp. The berries are dumped into water and the mature ones sink. They travel through pipes to a pulping-machine, where they pass between a roughened revolving cylinder and a curved iron plate, emerging in pulp form

Smoking Makes the Whole World Kin

How our neighbors prefer the weed

These aged Korean shopkeepers sit and smoke and smoke all day—except when a customer arrives. The Korean pipe is so long that the bowl rests on the ground. In shape they are not unlike the old English churchwarden pipe

In Bethlehem, Palestine, the women have coffee every morning and afternoon, and smoke the hookah. It is a pipe with a long, flexible stem and a water-tank attachment. The smoke is water-cooled before reaching the smoker's lips

"An' I seed her fust a-smokin' of a whackin' white cheroot—" That's what Kipling said about the Burmese girl on the road to Mandalay; and that's how we see her in the picture above, resting in the woods

She has just joined the old ladies' pipe-smoking club of Liége. She carries her own pipe and tobacco to the meeting and, between puffs, talks about the good old days, before the war, when the H. C. of L. was unknown

Bokumbi village, Belgian Congo, is the home town of these three blacks. They very obviously belong to the leisure class. The bowls of their pipes seem ridiculously small in comparison with the stems, but the smoke apparently is satisfactory

It Took Nerve to Do This Job

What Washington thought of O'Hara is told in this true story of two naval radio operators

By John W. Kean

WHILE Davis was melting ice on the wireless antenna, Zeider was having a chat over the signal wire with Hoke Fitzsimmons in Washington. O'Hara, the fun-maker of the trio, was telling Davis how to do his job.

"Zeider," Davis said, "I believe our bold shipmate thinks he knows something. To stop his chatter, ask Hoke what the Washington gang think of him."

Davis, Zeider, and O'Hara are chief electricians in the navy, attached to the powerful navy transatlantic radio station. The wire Zeider was working led from a place we will call Danapolis to room 2628, Navy Building, Washington.

IT was the latter part of January. For weeks it had been necessary to interrupt the sending of radio to melt ice on the antenna.

To melt the ice, the radio-sending machinery was disconnected and the antenna was connected with an ordinary electric current. This current, however, was a little too heavy for wires of the size of the antenna to handle properly. It caused the wires to heat and melt the ice.

Davis was sending as much electricity through the antenna as the wire could handle without blowing out his current-breaker.

"Here's the answer," Zeider shouted.

"O'Hara—is—full—of—pep—like — an — admiral's — aid — and—he—would—be—all right — if — "

Just then Davis's ice-melting circuit-breakers went out with a bang. They all hurried out into the fog and rain.

Looking aloft, they saw the cause of the trouble. The antenna wires were supported by steel cables stretched between the tops of the six-hundred-foot towers. These cables were not in the ice-melting circuit. They had become coated with ice, and the additional weight had forced them down, allowing the antenna which they supported to sag so low that it touched a lead-in wire and made a short circuit.

Zeider had been sending sufficient current through the antenna to heat up about ten miles of wire. When the antenna wires touched the lead-in wire, this current changed its course and escaped by a short cut to the earth, causing the explosion.

While the antenna wires touched the other wire the ice-melting circuit was out of commission, but—and this was more serious—the station itself was dead.

To put the station in commission it would be necessary for two men to climb to the top of the northeast tower and cut the wire that was touching the antenna.

O'Hara and Zeider were detailed to cut the wire. To save time they decided to carry up a plank, instead of employing a pulley and rope.

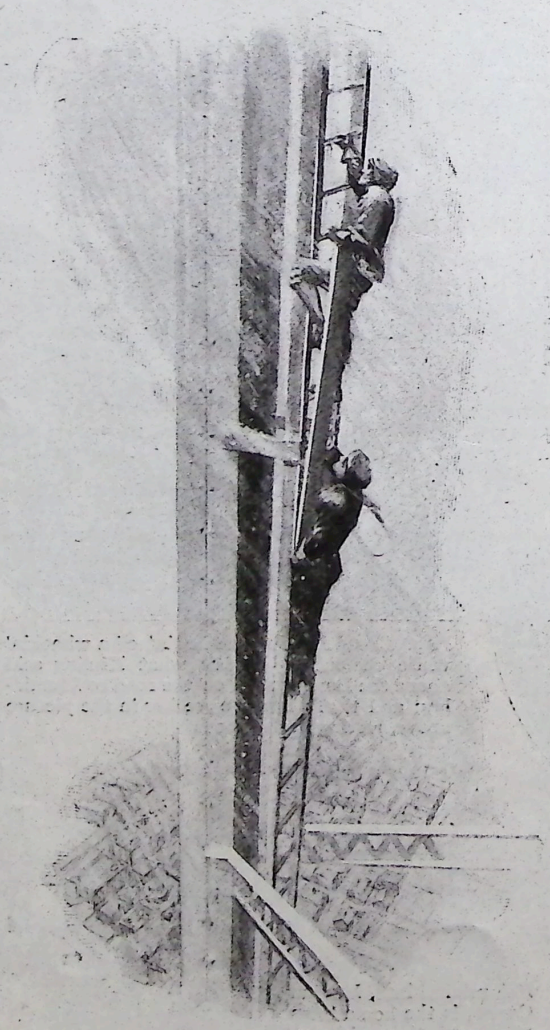
The rungs of the ladder were coated with ice. O'Hara went first, holding one end of the plank. With his left arm around the plank, he grasped a rung with his left hand, and reached up with his right to the next rung. He then moved his left hand up a rung. Scraping his feet on the rungs to get a secure footing, he made it fairly safe for Zeider.

The fog gradually hid the station and the bay. A fine, misty rain was falling. The plank was becoming slippery. The gloves on the men's hands also became slippery.

The plank, while a cumbersome and dangerous article to carry up the icy ladder, also proved a help. Several times O'Hara's hand slipped from the icy rung, but he was steadied by the plank held solidly by Zeider.

Five hundred feet up, the rungs grew more slippery. They had to stop while O'Hara jarred the ice to loosen it before taking hold. The plank also was becoming covered with a thin coating of ice. Away out on Chesapeake Bay a steamer picking its way through the fog blew its mournful whistle. They stopped for a moment for breath. After what seemed an eternity they reached the top.

It was now necessary to fasten the plank to the tower, with one end extending about six feet. Balanced on top of the spider web of steel nearly a hundred feet higher than the Washington Monument, O'Hara and Zeider finally succeeded in getting the slippery plank fastened. O'Hara then crawled out on his stomach to the end of the plank to cut the wire.



Several times O'Hara's hand slipped from the icy rung, but he was steadied by the plank held solidly by Zeider. It took the place to them of the mountaineers' rope

SLOWLY he felt his way along the plank, testing it as he went along to see if it would hold.

The plank held, but before starting to work he called back: "Zeider, what do you suppose he was going to say about me?"

"For heaven's sake, man, cut that wire!" Zeider said.

Working slowly, O'Hara severed the wire. They left the plank and hurried to the ground. In the power-house O'Hara, with a foolish smile on his good-natured face, said to Zeider: "Ask Hoke what Washington was going to say."

"O'Hara — would — be — all right—if—he—had—some—nerve!"

He Revolutionized Lumber-Drying

Harry Tiemann, who helped win the war

By Samuel J. Record

WHEN the United States joined the great fight, millions of gun-stocks, thousands of artillery wheels and transport wagons, as well as the proposed super-fleet of airplanes, called immediately for lumber; and not lumber merely, but *dry* lumber. Dried, too, in such a way that its strength and elastic properties would not be impaired.

Orders were issued for millions upon millions of feet of lumber while "the birds were still singing in the trees" whence it was to come. Our reserve stocks of dry wood had been drained by our allies. The time-hallowed method of curing oak, walnut, and hickory was to expose it to the air in open sheds or protected piles for from two to five years. There was no known method in general use for hastening the process without endangering the strength of the wood. Boards, shingles, and other thin lumber of the less refractory kinds had long been dried successfully in kilns with artificial heat; but stock of the kind and sizes for army specification might literally be torn to pieces by such treatment.

With the coming of the war, manufacturers realized that they would have to abandon the only way they knew of drying wood. Somehow they must make their dry-kilns do the seemingly impossible. They tried and failed.

The Government's Need Anticipated

At their wits' end, they turned to the United States Forest Service. Little did these manufacturers realize that on the staff of the Forest Products Laboratory at Madison, Wisconsin, was a man who had anticipated their problem years before and had evolved the formula for its solution. This man had discovered the secret of drying wood quickly, thoroughly, and without injury. It only remained to adapt his principles to a given set of conditions. It was as a rope to the drowning.

Who is this man? Harry Donald Tiemann, a government employee of seventeen years' loyal service. Of modest and retiring disposition, he has been content to slave for an ideal, with little thought for personal gain or advancement. His patents have been generously dedicated to the public, and they yield to the inventor not a cent of royalty. Within a narrow circle he is known round the world, and his kilns are being erected in the remotest corners of the earth.

How did he acquire his experience? In 1897 he received the degree of Mechanical Engineer from Stevens Institute of Technology. For a time he taught chemistry at Pratt Institute, in Brooklyn, and later was instructor in mechanical engineering at the University of Pennsylvania. This work was not exactly to his liking, and in 1901 he enrolled in the newly established School of Forestry at Yale, graduating two years later. It was at Yale that the opportunity came to him to combine his training in mechanics and chemistry with a knowledge of woods and a realization of the future needs of the lumber industry.

From 1903 until the autumn of 1909, when the Forest Products Laboratory was established at Madison, Mr. Tiemann had charge of the Yale Timber-Testing Laboratory, conducted in cooperation with the United States Forest Service. For six years, in the basement of Marsh Hall, he applied himself to a single problem—wood in relation to its moisture content. Thousands of different specimens—green, water-soaked, air-dried, kiln-dried, boiled, and steamed—were broken or crushed in testing-machines and the results carefully analyzed and tabulated.

His work at Madison has been largely a continuation and an amplification of that at Yale. Experimental kilns were erected in which the temperature, the humidity, and the circulation of the air were under accurate control, and where every stage of the drying operation could be closely followed.

Harry Donald Tiemann saved us from a serious lumber famine when we entered the war

Controlling the Drying Process

Mr. Tiemann's great contribution was the control of the drying process by the regulation of the humidity in the drying-chamber. He designed and patented his own type of kilns to accomplish this purpose. In addition he was able to modify existing types of kilns quickly and cheaply so that they would approximate the results of his own.

In these kilns black-walnut gun-stocks for army rifles were dried from green condition in sixty days, with a loss of only a small fraction of one per cent. Wheel stock of oak, ordinarily requiring from three to five years to season, was turned out in perfect condition in ninety days. Wing-beam material for airplanes was dried fresh from the tree in from twenty-four to thirty days, and was in better condition than the same material air-seasoned for a year or more.

It was thus that Mr. Tiemann averted a famine of dry lumber when dry lumber was indispensable to the nation's success.

He has completely revolutionized the lumber-drying process.

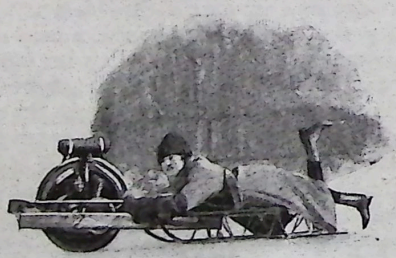
Mr. Tiemann is here shown instructing a class of manufacturers in his new quick method of drying lumber. The wood dries quickly, yet does not lose its strength

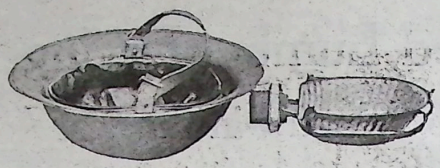
Now there Is a Double-Ended Vacuum Cleaner

NOW there is a vacuum cleaner that not only does your sweeping for you but dusts as well, without the need of any special attachments. The handle is equipped with a suction device; thus when you wish to draw the dust out of corners or from upholstered furniture, you hold the cleaner upside down and let the handle do the work, as shown in the picture above.

Inside the cloth dust-bag there is a paper bag which is easily removed and replaced when filled with dust. Thus the dirty and insanitary method of shaking the dust out of the cloth bag is eliminated.

The passageway through which the dust travels into the bag is transparent and you are able to see whether the fan is working properly or not.





Light up the Trench Hat

DON'T hang your old trench helmet in a closet where no one can see it; hang it rather from the ceiling and use it as an inverted-light fixture. You can buy a reflector that will fit inside when the lining is taken out. In place of the chin-strap you attach chains with which to fasten the hat to the ceiling. The wiring is done as usual.

Inverted lighting is considered much better for the eyes than direct lighting. At first only transparent globes were used for the purpose, but now metal ones are also used.

Trench helmets also make good flower-pots, saucepans, or fish-globes. If you brought any of them home with you, distribute them around the house, and if you have an extra one, put it in a tree for birds to live in.

Our Ears Deceive Us in Locating Sound

CAN we judge the direction of loud and soft sounds of different pitch with equal accuracy? Experiments have shown that we can not.

Blindfold a man and mark off a circle in ten-degree divisions around him. Start a sound in a certain part of this circle, but vary its intensity. Experimenters have found that the blindfolded man is deceived when the displacement of the source causes the sound to reach each ear with different intensity. He seems to hear a "phantom" sound which rotates horizontally around him as the intensity varies, when the vibrations are as slow as 256 a second; but with a frequency as high as 1024, the effect changes and sometimes disappears.

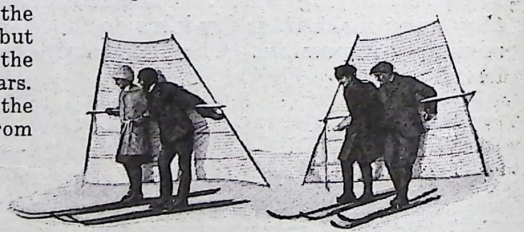
Moving the source of sound around the circle so the vibrations reach the ears from different angles, at 60 degrees displacement with 256 frequency, the observer hears the sound as though it came from 6.1 degrees.

A Pair of Trouble Gloves for the Automobile Driver

YOU wear high rubber boots when you wish to plow through heavy snow, why not wear long gloves when you have to dig through the mud and grease that accumulate on your car? You never know when you may have to change a tire, or adjust your carburetor, or tend to any other of the many ills that cars are heir to.

If you have a pair of long gloves like those above, tucked away in the pocket of your car, you need never worry about soiling your cuffs or sleeves when trouble occurs.

With overalls under the seat and long gloves in one of the pockets, you can wear your best clothes on a trip and know that they will be in no danger of soiling. With an extra pair of these gloves you need have no hesitation in calling upon others for help.

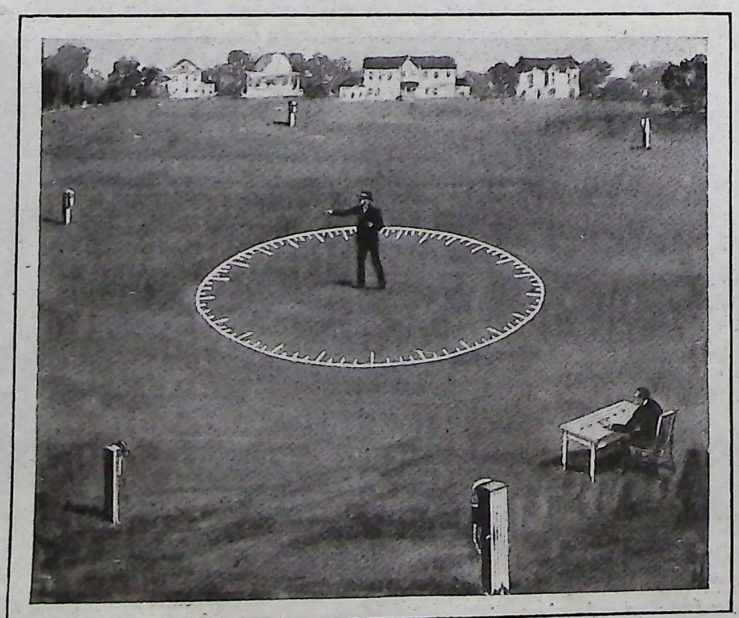


Use a Motor-Sled in Flat Country

UNLESS some one has been willing to drag you around, you haven't been able to do much sledding in flat country. But now that the motor wheel has made good on bicycles and small boys' express wagons, it is being tried out on sleds.

Above you see a motor-sled chugging its way across the smooth hard snow. It is able to attain a speed of more than twenty miles an hour. Thus before long we shall have a new type of speeder brought into court.

The motor wheel is attached to the front of the sled by means of a special wooden frame.



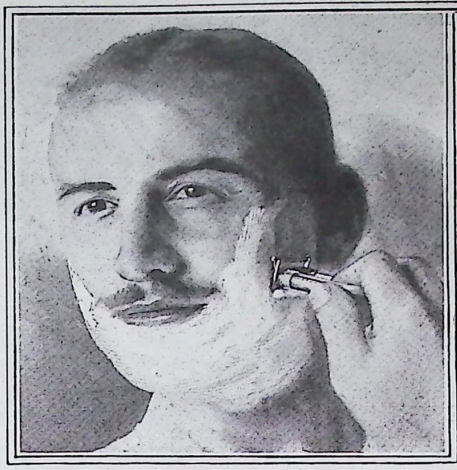
Ski-Sailing for Two in Modern Norway

SPEED—that's the secret of many sports. Take skiing, for instance. Even though skis carry you across the snow at a terrific rate of speed, many skiers are not satisfied. They want to go faster. How can it be done? By wearing a sail.

Above you see some people starting on a ski-sail in Norway.

One sail is used by two people. They put their arms through a bar across the middle of the sail and in this way they are able to guide it.

Even a slight breeze will have a marked effect on the speed of the skiers.



Shaving with a Side Motion

HERE is a razor whose blade moves from side to side as you draw it across your face. This double motion doubles the speed and accuracy with which each individual hair is chopped off. Thus it should not be necessary to scrape your face more than once when you shave.

The side-to-side motion is caused by a small roller connected with the blade. The roller touches your face as you draw the razor across it and its revolving motion is imparted by cams to the blade.

You can adjust the guard that holds the blade so that it will give you any kind of shave you desire.

Providing a Street-Car with Stilts to Keep People Dry

WHEN the floods from the Ohio river inundated some of the streets of Cincinnati, a unique arrangement was made to keep the high water from reaching the exposed parts of the street-car motors. The car which held the motive apparatus was mounted higher above the wheels, thus elevating the motor out of reach of the water.

In front of the short car containing the motive power is attached the car in which the passengers ride. When passing through parts of the flooded district, the water reached the floor of the passenger-car. Then the passengers had to stand upon the seats to keep their feet dry. Cincinnati is probably the only city in the world where this has been tried.

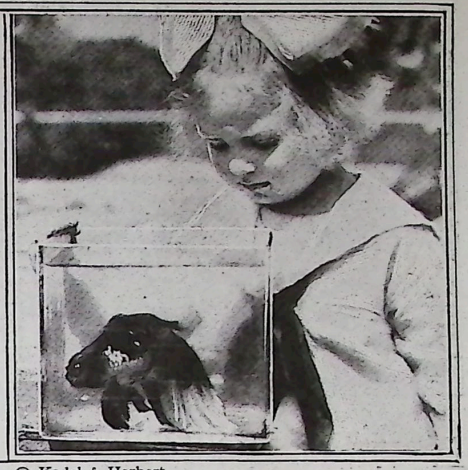
Lamps Under the Chair Keep Him Warm

BAD boys in Sunday supplements and movie villains are always building fires under other people's chairs. But none of them had anything to do with the two lighted lanterns that blaze away beneath the ticket-chopper at the Times Square, New York, subway station, whose picture is shown here.

He put the lanterns there himself, to keep from freezing on the job. He tucked his feet in a box lined with newspapers, sat on more newspapers, and leaned against still more. Thus he protected himself against one of the bitter cold shocks that New York is heir to.

This ticket-chopper is not the first person to realize the warming properties of newspapers. For years past housekeepers have spread newspapers under mattresses and carpets to keep drafts away; even between blankets, when bed-coverings were scarce.

Also as chest-protectors, newspapers are most satisfactory.



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A Champion Among Goldfish

OLD Black Joe has a namesake—a German-born goldfish that has been living in this country seventeen years. He was given that name because of his coal black color; but, strange to relate, when the United States entered the war with Germany, his color changed to red, white, and blue.

Old Black Joe, the fish, is worth more than a thousand dollars and he is the champion of the goldfish world. He belongs to the broadtail telescope class and, in spite of his eighteen years of life, is still full of vigor.

Our Black Joe is the father of over a million children. His owner would not sell him at any price.

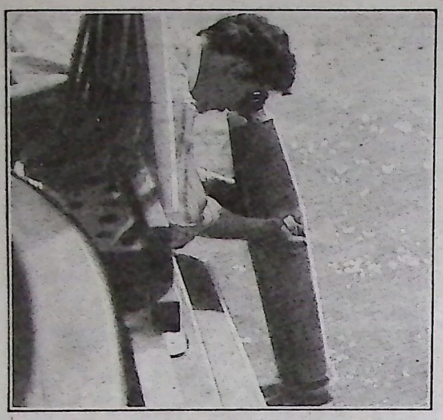
Hitch Your Skis to a Motorcycle and Travel Fast

SKIING is a thrilling sport at the least attempt, but when it is connected with various other motive sports it surpasses the mere sensation of thrills and enters the realm of real danger.

One of the least dangerous is the celebrated sport of the hills of Sweden and Norway. Old Dobbin is hitched up suitably and furnishes the fun for "skijoring."

But the gasoline engine thumping away in the frame of a motorcycle affords an element of speed that tugs at restraint. In a cloud of fine snow-powder the motorcycle guides the man on skis. He cuts through ruts and skims the surface of the snow. If he is skilful, he remains upright to the end of his journey.

© Keystone View Co.



Looking at the Ocean's Floor

THE bottom of the sea is undiscovered country to most of us who are not deep-sea divers. Now, however, there is a sea telescope that makes it possible for us to see clearly from the deck of a boat, objects a hundred feet below in clear water. It was invented specially for fishermen and salvage workers.

The tube is enclosed in an opaque covering and has at its lower end a circular plane glass. There are two eyepieces with elastic rims at the opposite end of the tube. These fit so closely around the eyes that all light is excluded. Since the plane-glass end is in direct contact with the water, no distortion takes place.

Watch now for the man who charges a dime to look through the sea telescope.

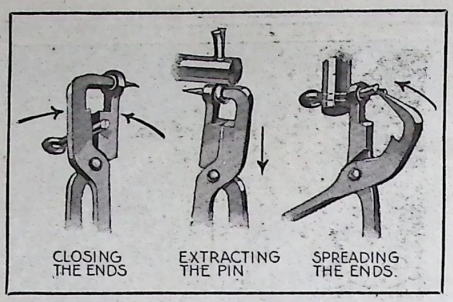
Banana Skins Can Be Used for Cleaning Shoes

BANANA skin has a bad name, owing to its unpleasant habit of making people slip.

But it is really quite useful. For example, it will clean and polish your shoes just as effectively as a regular shoe-polish.

You rub the inside of the skin on your shoe and the sticky substance there will absorb all the dirt. After it has dried on the shoe, you take a rag and rub it off. Your shoes will then be clean and shiny.

But of course if you don't happen to want a banana at the time when you want a shine, it would hardly be worth your while to buy one just for the sake of the skin. Bananas are entirely too expensive these days.



A Tool for Manipulating Cotter-Pins

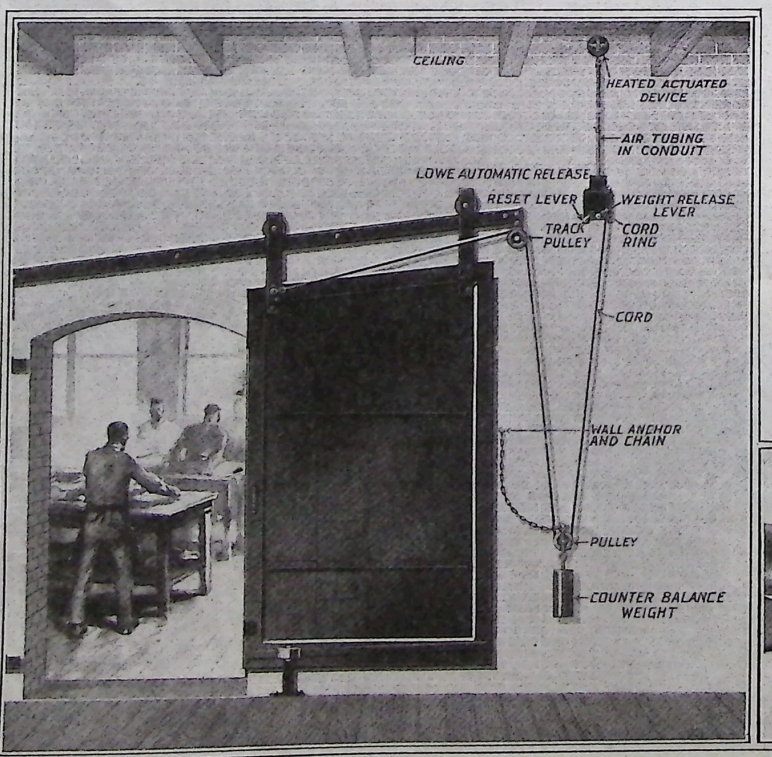
THE legs of cotter-pins are often hard to open and close; but there is now a tool to attend to this. There are two handles, pivoted together as in the case of a pair of scissors. One handle has a hole grooved out near the end, and the other terminates in a pyramid-shaped point that fits in the hole.

Suppose you wish to spread the legs of a new cotter-pin. You slip the legs through the hole and force the point between them by pressing on the handle.

An Automatic Fire-Door

SAFETY curtains, fire-doors, and all other devices for preventing the spread of fire, should be made to work automatically. In the confusion and excitement that accompany fires these devices are often overlooked.

In the picture below is shown a new automatic release attached to a fire-door in a factory. If the temperature should rise fifteen degrees a minute, as would happen in case of fire, the air would expand so rapidly that its pressure on a diaphragm in the device would cause a plunger to become disengaged. Whereupon a cord attached to the door, and on which a weight hangs, would be released. The door would close instantly.



Removing Old Paint Quickly

REMOVING old paint with a gasoline blow-torch is a tiresome job. Such work is made more pleasant and rapid with this new torch that burns acetylene gas.

The gas is supplied from the dissolved-acetylene tank which rests on the ground. It is connected with the blowpipe by means of a flexible hose of sufficient length to allow the operator freedom in his work.

The flame is extremely hot and therefore it is not necessary to hold it in contact with the paint very long. This enables a painter to cover a greater amount of surface. The flame used is so hot that the paint on a canvas surface can be heated and removed before the fabric underneath becomes hot enough to burn.

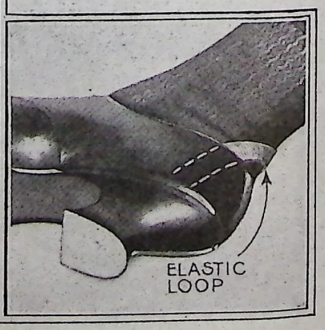
It Keeps the Low Shoes from Slipping Up and Down

NO matter how well your low shoes fit, they are likely to slip up and down on your heel when you walk. It isn't the shoes' fault; they simply are not as flexible as your feet.

What will give then this flexibility? A strip of elastic. You fit it inside the shoe and fasten it at each side of your heel.

The strip should be slightly shorter than the inside measurement of the heel of the shoe. It will then fit snugly against your heel and move up and down with it, removing that uncomfortable feeling of slipping.

This will be a welcome hint to those who dance, owing to the tendency of pumps to slip up and down after they have been worn once or twice.



A Speedometer for a Buggy

SHOULD you see what looks like a speedometer attached to the axle of a buggy, like as not the vehicle is being employed by the Soil Bureau of the United States Department of Agriculture.

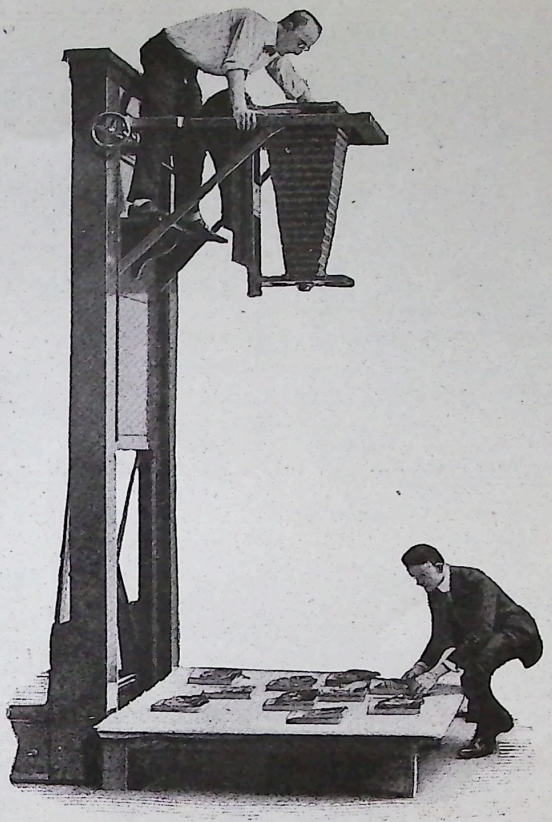
When thus employed, the principle of the speedometer is converted into an "odometer." It registers the distance traveled in the course of a survey.

The character of soil in one corner of a field may be different from that in another part. The distance between the sections from which soil samples are taken can be obtained readily by looking at the pointers on the face of the dial.

Steel Teeth to Cut the Ice

AN engine which can push a steel-chisel ice-cutter serves well to keep open winter transportation.

The sharp-pointed chisel-teeth dig deeply into the hard surface of ice, or the compact coating of frozen snow, and shove aside the broken pieces to clear the right of way. The invention occupies a place of distinction apart from the service of a snow-plow. Rushed into a hard ice-field, the snow-plow is of little use. But the difficulty is overcome when the metal teeth of the "ice-plow" crunch the glazed covering which a winter's storm has cast upon the street-car or the railroad tracks.



Focusing from Above with an Unusual "Tripod"

GET up into the air with your camera if you wish to take a photograph of merchandise for catalogue use.

This camera "tripod" was built especially for this purpose. Pictures can be taken quickly without the trouble of pinning the objects to the wall. The photographer stands back of his camera and brings it to a focus by adjusting the moving platform, up or down as the case may be. The photographer himself moves with the camera by manipulating the small hand wheel shown at his side.

This is a great improvement over the old method of taking catalogue photographs by fastening the objects against a white paper placed on the wall.

One advantage of this system is the ease with which the articles can be moved about.

A Hard Helmet to Crack

MINERS, structural steel-workers, and others who jeopardize their heads by working in places where rock, coal, or pieces of iron frequently fall, can find protection in the new "hard-boiled" cap which serves the purpose of a helmet. The cap is made of stiff material capable of withstanding a blow equal to that of a twenty-pound rock falling six feet—a pressure of four hundred pounds. It is water- and fire-proof and is a non-conductor of electricity.

A twenty-ounce bolt fell forty feet, struck a man's head, knocked him down, but left him unhurt.

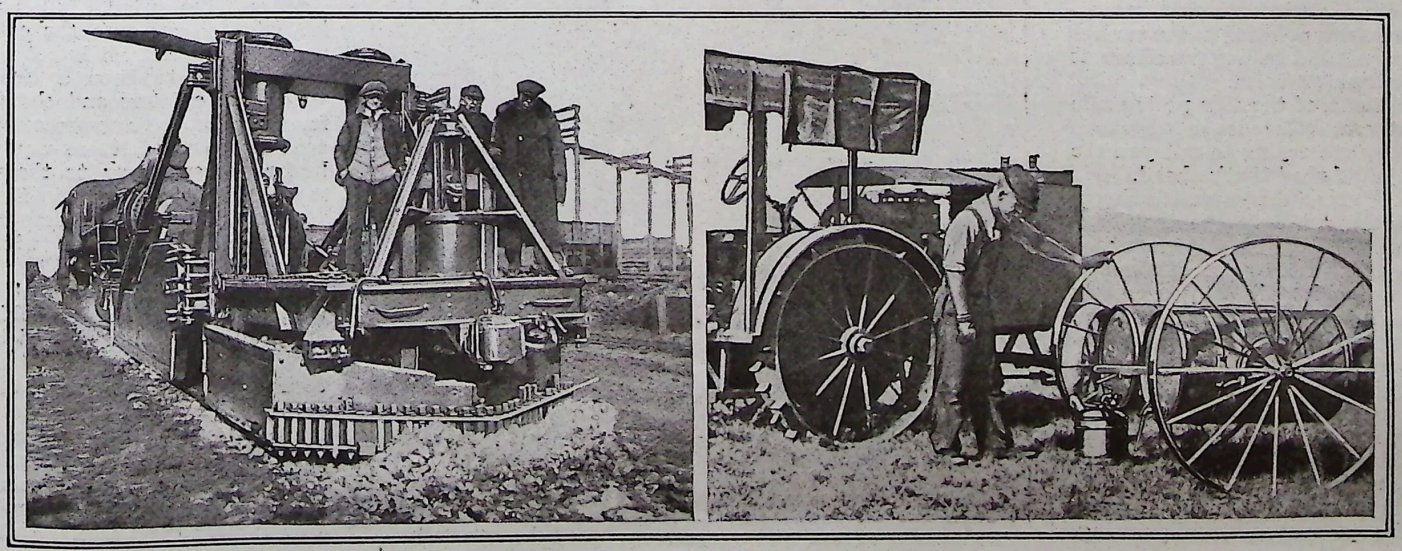
Many a fractured skull can be prevented by the wearing of this helmet.

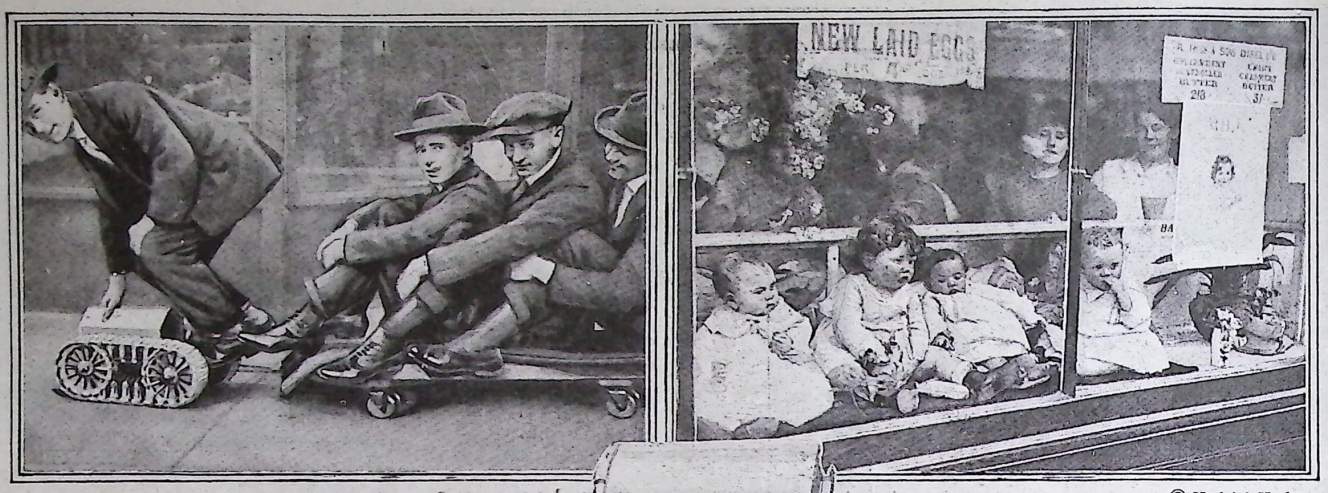
Carrying Gasoline on the Farm

WHEN one's tractor or gas engine is in use a mile or so from the house, and the "gas" gives out, it is not always easy to carry the supply across the plowed fields.

To meet this need of farmers a new form of tender has been placed on the market.

On two light but strong metal wheels are mounted steel drums in which to store gasoline, water, lubricating oil, etc. These drums are so constructed that when being transported they stand upright, on the wheels, but when gasoline is needed they can be tilted over so that the liquid will run out of the faucets, with which each tank is equipped.





© Kadel & Herbert

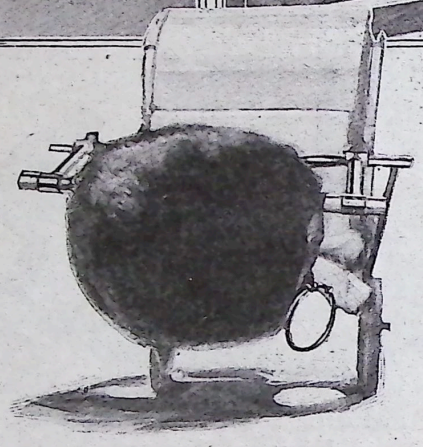
A Little Tank with a Big Job

IF you think this little tank is a toy, you are mistaken. It is a real worker—a hard worker. It is well constructed, has plenty of power, and, although a little slow, like the snail it finally gets there, even though pulling a heavy load. It has a gasoline motor, tractors, and everything.

A one-eighth-horsepower motor keeps this machine going and supplies it with enough power to pull a load of several persons.

When it is pulling a heavy load, a man must stand on the back to give it sufficient traction. Otherwise, the tractors would merely slide over the pavement. The control levers are placed at the back of the hood that covers the engine, where they will be within easy reach of the operator riding on the small platform.

An enterprising manufacturer constructed this gasoline miniature tank to see how much power he could get into a small space.



The Muff on the Carriage Handle

BABY must have plenty of good fresh air. In the wintertime a mother's hands get very cold on the handle of the perambulator. A humane inventor—very probably an experienced father—has invented a handle which will accommodate a muff so that the hands may be kept comfortably warm while little son or daughter is enjoying the fresh air.

One end of the handle swings on a pivot while the muff is placed on the opposite end. The handle is then slipped back into place, and mother goes on her way in comfort, regardless of the winter wind, snow, sleet, or hail.

How Babies Advertise Milk

THERE is no better advertisement for milk than a healthy one-year-old consumer. That's why a London dairyman put four strapping young milk-drinkers in his show-window. If people will stop to look at puppies in a window, surely they will look at babies with a much greater interest.

The mothers who so kindly lent their children to the dairyman stand in the background, ready to grab them should they cry.

But the children appear to be just as interested in the people outside as the people are in them, and they are not likely to let their emotions overcome them.

One of the chief advantages of advertising with animate objects is that they remain in the mind of the observer much longer than do inanimate ones, and have that much greater selling power, a fact that has not been overlooked by storekeepers and advertisers of all kinds.

Elaborately Carved Human Interest Sign-Posts

EVEN in their sign-posts the Germans display their love of elaborateness. Instead of having plain wooden or metal posts with arrows pointing to the various towns, highly carved tree-stumps are used. They are fashioned to represent human beings with extended arms—the arms pointing to the various towns, and having the distances written on them.

Some of the sign-posts smile at you; others frown. Perhaps they are trying to tell you the kind of road that's ahead.

A cheerful sign-post is shown to the right. A schoolboy hugs to his bosom his slate on which is written the name of the next town. He smiles at you sweetly and points toward the town, regardless of the fact that pointing is considered bad manners. The stump on which he dwells is a tall one and makes you think, at first, that the boy is wearing long dresses. These mileposts are only one of the many curious things that travelers through Europe are continually seeing.

© Ledger Photo Service

Protecting the Traffic Man with a Windshield

PHILADELPHIA comes to the front with a humane device to protect traffic policemen. Exposed to the bitter winds of winter, the traffic regulator has to keep a sharp lookout for offenders who do not obey his orders.

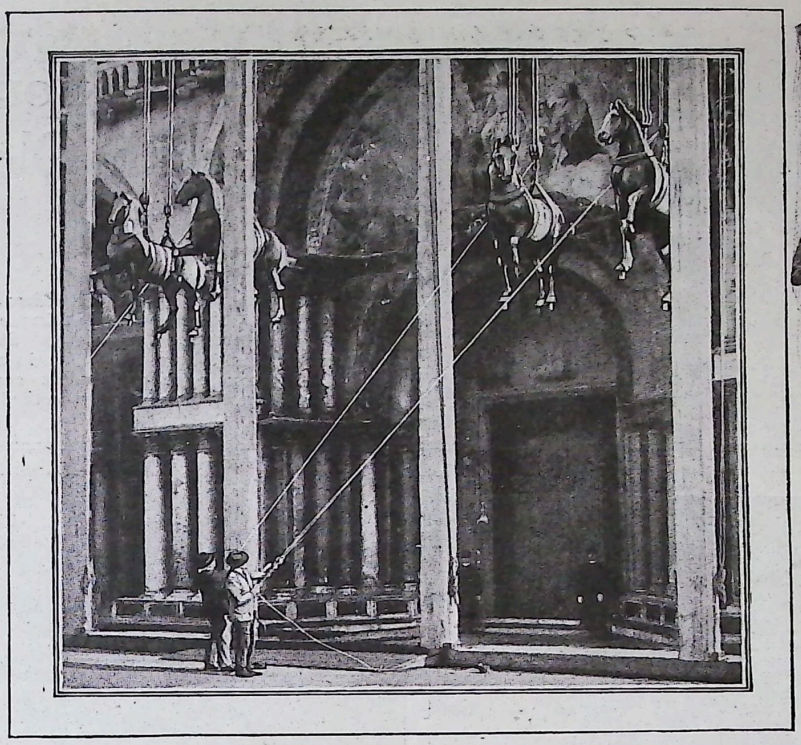
When the wind, full of ice-crystals, cuts into the corners of his eyelids, it is not an easy matter to keep a clear vision. If aviators and chauffeurs had to drive unprotected against the wind, there would be far greater danger to themselves and to others. But windshields enable them to bear the brunt of the wind easily.

Based on this plan, the traffic policemen of Philadelphia are equipped with a windshield sufficiently large to protect their eyes. Apart from the additional comfort experienced by the user of the windshield, those who drive and those who walk, receive that much more efficient service from the man who makes streets safe.

This Cork Cannot Escape Its Fate

"WHERE is that cork?" you ask, after you open a bottle and the cork slips out of your hands. The little wire handcuff on this cork keeps it where it belongs—attached to the bottle. It is very simple.

A single piece of small-gage wire which has several bends does the trick. It can be used on a bottle of any size and it adds practically nothing to its cost. The cork is free to move the necessary distance to let the liquid out.



The Return of the Four Bronze Horses of Venice

BEFORE the war, when you could tour Europe for a few hundred dollars, your guide would invariably lead you to the entrance of the church of St. Mark in Venice and point grandly at the four bronze horses at the entrance. But during the war the famous four disappeared—they were removed to Rome for safekeeping. Now they are back again, none the worse for wear or war.

It was not an easy job to move those horses. They had to be hoisted down carefully, then placed on specially built wooden trestles and dragged through the streets to the station. During their visit to Rome they stood in the garden of the Palazzo Venezia, the residence of the Austrian ambassador to the Vatican.

The above picture shows them on the last leg of their journey—being hoisted back into place. A solemn service of thanksgiving was held in the church when the horses had once more resumed their rightful positions.

© International Film Co.

Gloves that Were Struck by Lightning

DON'T open your umbrella in a heavy thunderstorm, even though it will mean ruining a new hat. Umbrellas attract lightning and may lead to injury or sudden death. Above you see a mutilated pair of gloves that were worn by a woman who was holding an umbrella when lightning came her way.

It ran down the umbrella handle, tore the gloves, and burned the woman badly about the head and shoulders. Lightning always seeks the earth, and umbrella handles are good conductors.

The Trunk Bandit

THERE is always a great trunk mystery raging as the history of crime goes on. One of the recent trunk affairs involves a burglar who had himself locked in a trunk by his confederates and shipped to a vault in a large storage company. In the dead of night he planned to creep out and take his pick of the valuable jewels and furs around him.

But it so happened that he raised the lid long before the dead of night. Private detectives, who chanced to be present at the time, arrested him before he was able to get out.

Below you can see the would-be burglar and the brave detectives who captured him.

© Keystone View Co.

Ostrich Eggs for Luncheon

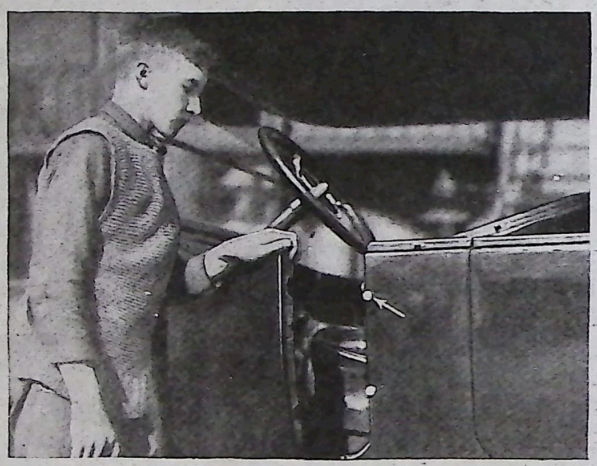
AN ostrich-egg omelet was prepared especially for the thirty-two guests of a film star at a luncheon recently given by her at a fashionable hotel in Santa Barbara, California.

In arranging the menu, it was decided to have something in the way of a novelty to offer the guests. The star chartered an airplane and made a hurried trip to a famous ostrich farm, near Los Angeles, where two freshly laid ostrich eggs were secured at eleven dollars apiece.

In the hotel kitchen the chef broke the eggs with a sledge-hammer. One egg just filled a large chafing-dish and proved to be similar in appearance to an ordinary hen-egg.

What You Can Do with Old Corks

Instead of making considerable noise, corks now hush things up. To prevent a window from rattling, bore two holes in the bottom edge and insert corks as shown in the picture on the left



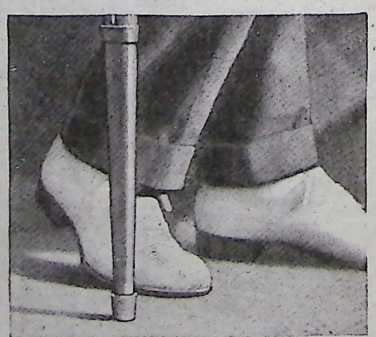
If the latch on the door of your automobile is hard to work, you are apt to lose your temper and slam it shut hard. Why not soften the blow by applying corks?

Automobiles are always developing new "canary-bird" squeaks. The doors and windows are usually to blame. Two corks will take the squeak and rattle out of any of them

Few things can be more annoying to sensitive nerves than a door that always bangs. That was a fault of the door shown above, until its owner fastened four small corks to the door-frame and insured quiet door-closing

If a ladder slips when you are on it, you will surely have to give up the pursuit of happiness for at least a week. A cork on each foot of the ladder will keep it firm and safe

This ex-soldier must carry his crutch a long time. But he gets along very well, especially since he had the idea of attaching a cork to the end of the crutch to ease the jar



Keeping Up with the March of Science

Facts for the man who wants to know

Dyed Sugar Just as Sweet

THE appearance of "rainbow" sugar has brought about an investigation by the United States Bureau of Chemistry. Harmless dyes were found to have been used in producing the various tints.

But the Department of Agriculture intends to keep a sharp lookout for the appearance of other than harmless colors.

It is continuing the testing of the "colored" brands of sugar that are supplied to certain grocery dealers. It will also see that the sugar is not inferior, and that the prismatic tints have not been added to camouflage some defect.

The Power in a Tree

A YOUNG man wished to measure the force that drives the sap upward in trees and shrubs. So he cut a vine and tied a bladder over its end. In two hours the bladder was greatly distended, and inside of three hours it burst with a *plop*, so great is the force that drives sap upward.

Tobacco Leads

MORE money is spent in this country on tobacco than on automobiles! When you compare the price of a cigarette with the price of an automobile, you realize the enormous amount of tobacco that must be consumed in order to give the tobacco business the supremacy.

Statistics gathered by the Treasury Department show that two billion dollars is spent on automobiles in a year, whereas an extra two hundred million goes into tobacco.

We spend one billion on candy and fifty million on chewing-gum.

American Houses for France

IN spite of the critical house shortage in our own country, builders find it expedient to construct a thousand wooden houses for France. Five hundred houses have already been shipped in sections that will be put together when they reach their destination. The windows, doors, paint, nails, and bolts go with each house.

When erected, each house will consist of three rooms and a shed and will occupy about twenty-three feet square. The houses will be erected in the Arras and Lens districts.

A Dearth of Golf-Balls

THE golf-ball manufacturers are barely able to produce enough golf-balls to meet the demand. England, for instance, used seven million balls this year! It is twice the number that were used before the war.

Orders for balls from Australia, Canada, Africa, and India have increased proportionately, and the United States has been able to secure a strong hold on the market.

Recognizing Real Mahogany

YOU buy a "mahogany" table, pay a good price for it, and then begin to wonder whether it is made of real mahogany. Red gum can be made to look so much like mahogany and Circassian walnut that it is often sold for one or the other of these woods.

How can you tell the difference between the false and the true? By looking at the cross-grain; if you can see the pores with the naked eye, then you will know that all is well. If you can't see the pores without the aid of a magnifying-glass, then you will know that you are in the presence of red gum.

Even through varnish the pores of mahogany and walnut are distinctly visible.

How Carbon Black Is Made

HOW is carbon black made? By burning oil or natural gas. But the carbon obtained from gas is much blacker and better than the carbon from oil.

Gas-burners are erected underneath steel channels that move back and forth. The carbon is deposited on these channels, but it is constantly scraped off by their movement against each other. Only 1.5 per cent of the total carbon in the gas is recovered in the form of black; thus the waste of gas is enormous. Scientists are now trying to produce carbon from gas by mixing it with other gases without necessitating combustion.

Rivaling the Sun

THE sun gives the earth a large part of the earth's heat, but we inhabitants contribute to the remainder. Wilhelm Schmidt investigated the warmth of Vienna, Berlin, and Potsdam, and he found that one sixth of the heat in Vienna was caused by earthly objects. In Berlin and Potsdam the percentage was even higher — one third! In New York, the largest city in the world, the percentage is highest of all.

In Vienna, the people, the animals, and the fuel burned give off seven billion kilogram-calories of heat in a year.

The Average Hair Crop

THE Bible tells us that the hairs of our head are numbered, but it does not tell us even the approximate number a square inch.

But some one has figured this out for us. He counted the hairs in a square inch on many heads.

On the average head there are a thousand hairs to each square inch. Find out the number of square inches in your scalp and you will soon know the approximate number of hairs on it.

We are also told that four hairs will suspend a one-pound weight. Therefore an average head of hair should be able to support the combined weight of two hundred people. Don't try it.

How to Sleep

WHAT happens to your body when you sleep? First, your breathing slows down and your heart drops six or eight beats a minute. Then cellular repair begins. The muscles, nerves, and tissues get new life; your whole body breathes more freely.

When you waken you should feel refreshed. If you don't, perhaps you have slept too long; or slept in a room not properly ventilated. Eating heavily before retiring will also make you wake up tired.

When you go to sleep, stretch out. If you draw your knees up under your chin your body will not relax properly. Small pillows and light bedding are also recommended.

If you follow all these rules and sleep eight hours every night, you will wake up full of pep each morning.

Seal Flippers Produce Glue

SEALS are out of luck now that fashion calls for sealskin coats. Many thousands of them are killed each year. And the flippers that heretofore have gone to waste are now being considered possible glue-producers.

The Bureau of Standards has recently experimented with some flippers and has found that they yield glue equal to sixty-seven per cent of their weight. The average weight of the four flippers of a seal is about eight pounds.

Radiotelephony on the Farm

MICHIGAN farmers who live far away from civilization will soon be able to know what's happening in the big city at any time of the day. The Michigan Agricultural College has planned a system of wireless telephones to be installed on all the large far-distant farms.

The Michigan farmer will be able to know at all times the market prices of his products. He will receive weather forecasts and listen to lectures or music when he has nothing else to do. His equipment provides for receiving messages, but not for sending them.

Wood Absorbs Explosives

BOXES and kegs that have been used for carrying explosives are often sent out again, unwashed. As a result many accidents have occurred. Black blasting-powder, for instance, is usually shipped in kegs.

Even though the powder is dumped out carefully, some of it remains in the cracks. Should the kegs be used again by some one who knew nothing of the former contents, an explosion might easily occur.

Nitroglycerin will sometimes exude from dynamite sticks. If the sticks are shipped in a wooden box, the nitroglycerin is apt to be absorbed by the wood. Any box that shows the slightest stain should be de-

stroyed immediately. All others should be well washed before they are sent out into the world again.

Heat Reflection in the City

"IT'S so hot in the city!" That's what the suburbanites say when they go to town in the summertime. Why does it seem hotter in the city? Because of the pavement. The sun's rays hit the sidewalk and bound back in your face. If there are no trees or grass around to absorb some of the heat, the temperature is several degrees higher than in the country.

Engineers have taken the temperature at varying distances above asphalt, brick, and concrete roads, together with the temperature above a lawn in the vicinity. Results have shown a difference of several degrees.

Whitewash Wood for Safety

ONE spark will sometimes lead to the loss of thousands of dollars' worth of lumber. Therefore it is essential that fire preventives be used whenever possible. The Forest Products laboratory announces that the most practical preventive so far discovered is ordinary whitewash.

A coat of whitewash will not necessarily keep wood from burning under severe conditions, but it will greatly decrease the danger of a blaze's spreading. A single spark, for instance, would die a natural death in the midst of whitewashed wood.

Nettle Fabric for Linen

SINCE Russia has been in a turmoil linen has become scarce; for Russia was long the world's greatest flax-producer.

Professor O. Richter of Vienna makes the proposal that the nettle plant be used as a substitute for flax. It is not a new proposal, but it assumes commercial importance just now because Richter has devised a process for treating the resistant nettle so that textile mills can spin its strong, tough fibers. A thread of nettle consisting of three fibers can support a weight of two and one quarter pounds.

Preserving Explosives

ANDRE LEFÈVRE, French minister of war, also a distinguished chemist, recently startled the Chamber of Deputies with the proposal to store the French stock of guncotton and nitrocellulose explosives in one of the lakes of the Pyrenees.

France has on hand about ninety thousand tons of high explosives, enough to last her three hundred battle-days, even at the enormous rate at which powder was consumed during the war.

Explosives deteriorate with time. Chemical decomposition begins sooner or later if the mass of explosive is not kept at a safe and constant temperature. The temperature of the water of Pyrenean lakes never varies more than four or five degrees.

Hence M. Lefèvre would sink France's stock of war explosives in waterproof tanks in the lakes and keep them thus for decades.

Fireproofing a Thresher

THE dust in a thresher mixed with air may be as explosive as gasoline in an automobile engine. A tiny spark of electricity is enough to fire the dust-laden air in a thresher. Hence insurance companies charge high rates for threshers—as much as eighty to one hundred dollars for each one thousand dollars' worth of property insured.

What was wanted was a device to prevent thresher dust from exploding. It has been invented by engineers of the Department of Agriculture in cooperation with manufacturers of threshing machinery.

Charges of static electricity—the kind that you generate by friction—are carried off by a special wiring system, which may be regarded as a miniature lightning conductor.

Fire-extinguishers are attached to the separators. Thus the danger from explosion and fire is minimized. Moreover, a fan is installed which cleans the grain, particularly of smut. Hence the smut spores cannot be disseminated by wind to infect wheatfields, as has been the case for many years past.

Sodium Instead of Copper

WHEN Germany was hard pressed for copper electric conductors, von Bett, a physicist, suggested that sodium would be an acceptable substitute.

The conductivity of sodium is about equal to that of zinc and about one third that of copper, but since the specific gravity of sodium is small, it is a better conductor, weight for weight, than any metal.

On the other hand, sodium has a very low melting-point and cannot be drawn into wire. Moreover, it cannot be exposed to the air.

Therefore the experiment was made of filling thin-walled iron tubes, painted as a protection against rust, with fluid sodium. The experiment was successful.

Whether or not such conductors as these can be introduced commercially, depends upon the possibility of drawing the tubes cheaply. Sodium is now made cheaply from common table-salt by electrolysis.

Weeding Out the Unfit

THE American army was the first in history that tested not only the physical fitness of a recruit, but his mental fitness as well. There were few feeble-minded soldiers in the A. E. F.

Shortly before his death, Dr. E. E. Southard, of Harvard University, suggested that the same methods be applied to industry.

If a man has been found unfit to fight because of his nervous and mental construction, he is probably also unfit to work under certain conditions. Every large, well-conducted plant has a staff of physicians to look after the physical well-being of the employees, but as yet no plant employs a psychiatrist.

Southard succeeded in having men pass the regular physical examinations in plants, who were totally unfit for employment in difficult positions. On the other hand, he was able to show many a grouchy, "queer," and otherwise "difficult" person how to make a living. Carry out Southard's suggestions in plants and we will have fewer undesirable "floaters," more workmen who own homes, and fewer ruinous strikes.

Bacteria for Sausage Skins

SAUSAGE skins are usually made of entrails, but parchment paper and denitrated wood pulp have also been used. Now comes the daring proposal to make them of bacteria. The particular species of bacterium employed is called xilinum and is found in vinegar.

Xilinum has been the dread of the vinegar-maker and manifests itself in an objectionable slimy scum. Some years ago a process was patented for converting xilinum bacteria into leather, and now a Dr. Wuestenfeld would use them in the making of sausage skins. Xilinum skin is obtained, of course, only in flat sheets.

No one has succeeded in inducing xilinum to breed tubes. The sausage meat must be wrapped in the skin and then sewed up.

Can You Hear Colors?

OUT of twenty-five people who read this, at least one can hear colors. To hear a color seems about as ridiculous as to see sound; yet color-hearing is a phenomenon well known to psychologists. To a color-hearer a trumpet-note appears red, an oboe-note a brilliant yellow, and the bass note of a big brass instrument purple or deep green. Even names suggest hues to the color-hearer, probably because each vowel has its characteristic shade. What is the explanation?

Perhaps the optic nerve and auditory nerve touch each other at some place in the brain, so that the auditory nerve transmits a sound to the point of contact, after which the optic nerve is excited.

Metal that Lubricates Itself

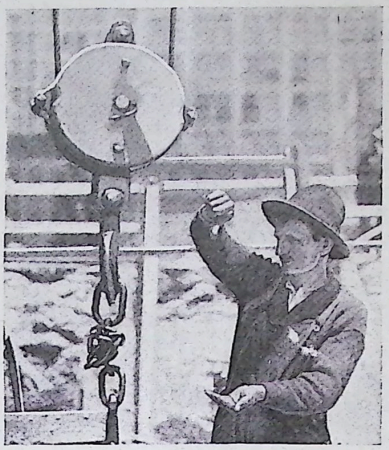
THE lubrication of bearings is necessary in order to prevent "hot boxes" and "seizing." Two contacting metals in motion "seize" when the microscopic hills in the one mesh with the microscopic valleys in the other. It is the function of the lubricant to keep the metals apart.

Now comes an inventor with a metal which will run hot and which will not "seize" because he has found a way of combining graphite with it. This is probably the first time that any one has succeeded in combining a non-metal with a metal. An alloy of aluminum and graphite gives better results than the usual phosphor-bronze-bearing alloy at the same speed and pressure.

Must the Cat Go?

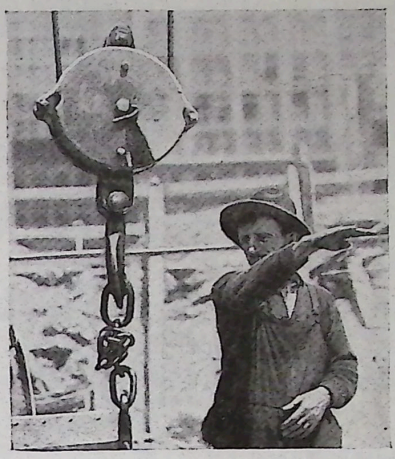
DR. A. K. FISHER, of the United States Biological Survey, estimates that the cats of New York State destroy 3,500,000 birds annually. A. H. Pratt estimates that Illinois cats kill 2,508,530 birds annually. Massachusetts cats are credited with destroying about 2,000,000.

A Crane with a Code Is Soon Started

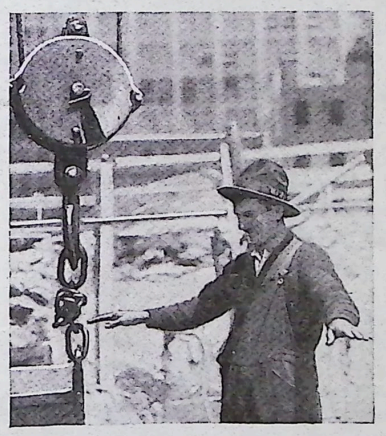


"Boom down" and "Hoist load" signals are just the reverse of "Boom up," "Lower load" signals. The right thumb goes down and the left palm is turned up

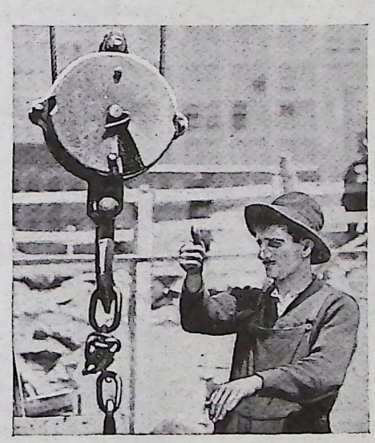
After all, the code of the crane is really quite simple. A left motion is indicated by a left gesture, and a right motion by a right gesture; to wit: the gesture below means "swing right"



"Swing left"—indicated by a sweeping swing of the right arm to the left. George Kelley, a master mechanic, who helps build skyscrapers, is shown executing a left swing



'Stop!" What is the best way to signal it? Mr. Kelley spreads out his arms with both palms facing downward. The man operating the derrick watches him closely



Right thumb up, in this case, means "Boom up;" left hand outstretched with palm down means "Lower load." Both of these orders can be combined or given separately

Building means digging, and digging means derricks. While the man on the derrick operates the bucket by control levers, he takes orders from a man on the ground, who signals with his hands

Five Thousand Pigeons in a Race

Some of the five thousand carrier pigeons in the race making a mile-a-minute speed. These birds were sent off from places within a radius of five hundred miles of St. Louis

FROM towns within a radius of five hundred miles of St. Louis, Missouri, five thousand homing pigeons were released in one of the most remarkable races of its kind ever held in this country. At the speed of a mile a minute these feathered letter-carriers competed for prizes, the winners being the pigeons that first arrived home and registered inside their loft compartment.

The race was a feature of the convention of druggists held in St. Louis in September last.

The lofts where the homers were trained for the race, are one hundred and eighty feet long and have two floors with eighteen compartments on each floor, each one being ten by fifteen feet.

The lower floor is used only for breeders, while the upper loft is given up to the young birds in training. The roof of each upper compartment is painted a different color and the birds have been taught to identify themselves with the color of their own loft.

Photographs by courtesy of the Rexall Drug Co.

The upper compartments of the pigeon-loft. The homer alights upon the platform in front of his compartment, and enters through a door that opens inward. His racing time is taken only when he arrives inside

In training, the homers are conveyed varying distances from their loft and are released. They will fly straight home, settling upon the platform whose color they are trained to recognize

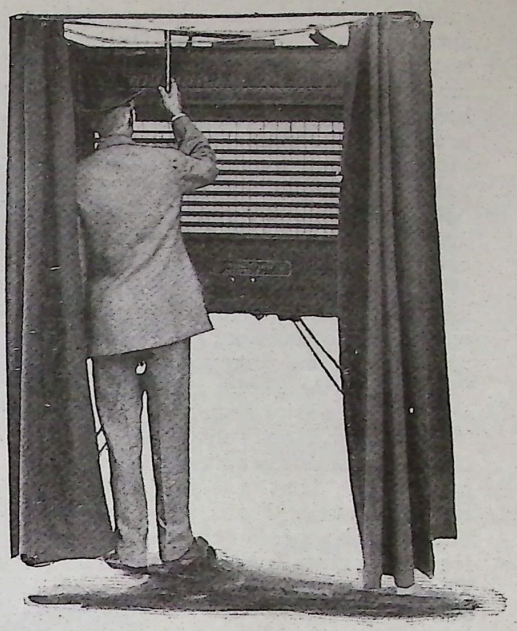
Voting by Machine

One way to insure an honest election

By Raymond Francis Yates

HOW much do election frauds cost this country every year? The figure has never been made known. It would probably run well into the millions. Our election laws make fraud easy. There is one case on record where the investigation and correction of fraud required an expenditure of eighty thousand dollars and four years' time. Who paid the cost? The taxpayers, of course.

The ballot method of election ought to be extinct in a mechanical age. We Americans are prone to boast of our mechanical ingenuity and to forget that we have an election system that was old in Cæsar's time. The mere existence of the cash-register and adding-machine ought to make us ashamed of our election system. The voting-machine insures honest elections.



The voting-machine cannot be manipulated until the voter pulls the curtain about him, which releases the registering mechanism. This insures a secret ballot and eliminates fraud

THE average American feels very important when he goes into the election booth to cast his vote, understanding, as he does, that he is discharging one of his most sacred duties as a citizen.

Yet while an election officer is unfolding the ballots, he may "accidentally" tear a few. If he is clever, he may have a small piece of lead concealed under one of his finger-nails. He can do one of two things with this lead. He can mark a ballot in a way that will render it void, or he can place a cross next to the name of a man who was not voted for. He may decide to punch a hole through the ballot with his pencil-point, which would at once invalidate the vote. There are numerous other tricks to deprive an honest voter of his vote.

Comparatively few people know that it is possible to sell their votes. How would the politicians know they had "delivered the goods," you say? Most states provide a space for the voter to vote for persons not nominated. It is perfectly legal for the voter to vote for himself. If John Jones sells his vote to one of the parties, the ballot he used in voting can be identified by his name in the space allotted for it. This is simple enough and perfectly legal. The ballot laws actually encourage this practice. In the few states where no such provision is made on the ballots, other methods of identification are in use. Some states provide that the ballots must be folded in a certain way to be legal. When they are folded in this way, the marks show through the paper.

The ballot can be rendered invalid by the slightest mark. A cross, a single line, no matter how short, added to the ballot nullifies it. Election officers often take advantage of this fact in eliminating as many votes as possible belonging to the other party. At one time it was the practice on the East Side of New York to throw ballot-boxes into the river.

Stuffing the ballot-box is a merry game. Under the voting laws, each voter is entitled to one vote only. What is going to prevent more than one ballot from being placed in the box under one voter's number? The law? The law does not prevent ballots from mysteriously finding their way into the boxes. This fact is so generally known that laws have been made that state what disposition is to be made of votes cast in this illegal manner.

If all of the voters were honest or if all of the election officers were honest and watchful, stuffing might be impossible. One of the serious defects of the present voting system is the opportunity it offers for illegal practices. While the opportunity for cheating exists, honest elections will be unpopular with those in charge.

The ballot system is costly and grossly inefficient. In the larger cities the cost of an election runs well into hundreds of thousands of dollars. Each election district must be officered by men who receive from six to twelve dollars for their day's work. After the election is over, the votes must be counted by hand—a long, laborious task, pregnant with the danger of mistakes. As long as the counting of votes is done "by hand," an unreliable method of election will exist that cannot be more honest or trustworthy than the persons conducting it.

Many attempts have been made to perfect a machine or device that will make the mechanical registration of votes possible. While there are certain problems in connection with the perfection of a reliable machine, there is no reason why it could not have been done many years ago. The adding-machine had its birth in the fifteenth century. It paved the way for the voting-machine, but several centuries

After each election the machines are sealed and placed in a heavy case, where they remain until the next election

rolled by before the voting-machine actually came into being. During the last half century many attempts were made to bring voting to a mechanical basis, but few of these held any promise of success. A man in Baltimore invented a machine with which votes were registered by rolling small balls into channels provided for each voter. At the end of an election it was necessary only to count the balls. When the machine was tested, a few hoodlums put chewing-gum in it and wrecked the election. Another man proposed registering votes by having the voter punch holes in paper. This also passed out of existence.

Rochester, New York, was one of the first cities in this country to try voting-machines. That was in 1878. The city is still using them. Not only this, but sixty-five per cent of the voting in New York state is done by this method. The complete returns of a large city can be made known within one hour after the polls close. In the city of Niagara Falls, where the voting-machine has been in use a number of years, the returns of the election are made known and the "extras" printed and on the streets for sale within forty-five minutes. In Buffalo, a city of over half a million population, the election returns are made public one hour after the polls close.

This voting-machine is strictly a mechanical device. It operates with mathematical accuracy. Before the voter can cast his ballot he must pull the curtain of the machine about him with a handle provided for the purpose. This insures a secret ballot; the act also unlocks the machine. When the curtain is opened, the machine is relocked and cannot be manipulated.

After the voter pulls the curtain about him, he sees before him a board on which the names of the candidates of the various parties are arranged in rows. The Republican party occupies one row; the Democratic party another, etc. Over the name of each voter is a small lever. It is necessary only to throw this lever down to vote for a candidate. If the voter desires to vote a "straight ticket," he has only to pull down all the levers in the party row. Levers are also provided to vote "Yes" or "No" on questions. When the voter has thrown the levers down over his candidates, he pulls the curtain back and steps out.

While the curtain conceals the voter, he may make any changes he desires, since the vote is not registered until he pulls the curtain back and departs. It is possible only to cast one vote for each office. For instance, when one candidate for mayor is voted for, the lever over the other candidates for the mayoralty are automatically locked and cannot be operated until the other lever is lifted in case a change is desired.

The Integrity of the Voting-Machine

But can't some one open the back of the machine and change the registered number for any candidate?

When the machine is in use, the back doors are locked, and they cannot be opened even with the keys provided for the purpose. On the other hand, when the back of the machine is opened to read the result, the levers on the front are inoperative. There is also a counter on the machine that registers every time the back doors of the machine are opened. A counter also registers every time the curtains are pulled together, thereby keeping a record of the number of votes cast. When the election is over, a seal is placed on the locking device of the curtain, and the seal cannot be removed until the next election without detection.

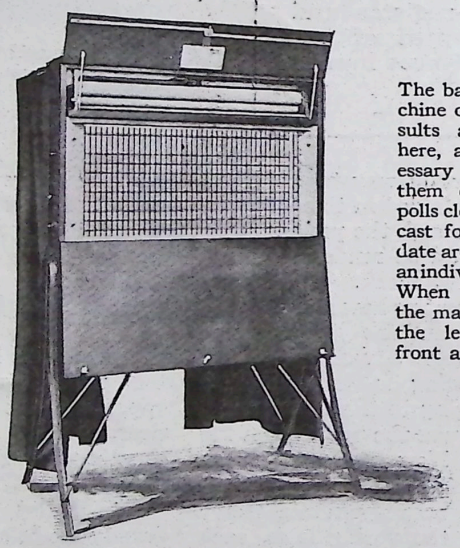
Plot and plan, scheme and engineer as he may, the crooked ward-heeler cannot discover a way of cheating the machine. After the election the machine is placed in a strong packing-case and sealed up until the following year.

The machine is honest, and its honesty is fully protected from those who would destroy it.

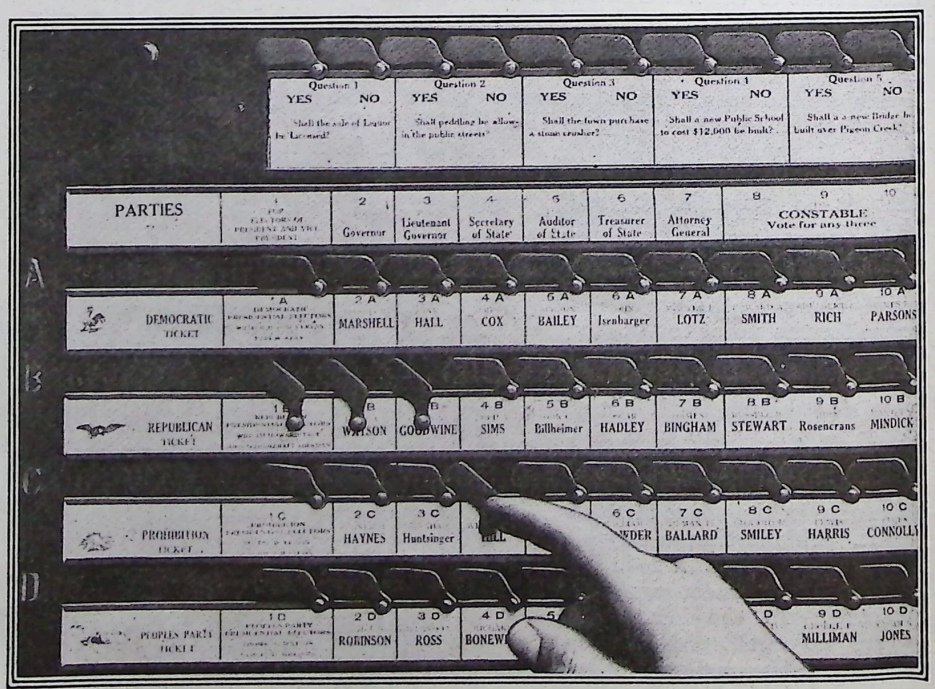
Voting mechanically greatly reduces election costs. The number of clerks in each district and the number of election districts are reduced. This is made possible by the rapidity with which the voters are handled. Hence more voters can be crowded into a district.

In the city of Buffalo, the number of election districts was reduced from one hundred and fifty to one hundred and eight after the introduction of the voting-machine. This reduced the election costs fourteen thousand dollars a year, besides eliminating fraud.

Expensive recounts and contests are avoided through the use of machines. In the case of a recount, it is necessary merely to remove the machines from their cases and re-copy the results. The dictum of the machine is absolutely final. This avoids expensive contests in the courts, where long and costly litigation often results.



The back of the machine open. The results are registered here, and it is necessary only to copy them off when the polls close. The votes cast for each candidate are registered on an individual counter. When the back of the machine is open, the levers on the front are inoperative



In voting by machine it is necessary merely to throw the lever down over the name of the candidate one wishes to vote for. When the voter pulls back the curtains that screen the booth, his vote is registered

His Master's Voice—Loud and Deep

THE superintendent of a large American electrical plant was called into a conference. While waiting for it to start, he gazed out of the window at the busy yards a short distance away. Suddenly he noticed a load of material coming down the track. The foreman was in another part of the yard and could not see it.

The superintendent, up in the conference room, turned his head and in an ordinary speaking voice said, "Open your switch; load coming." Immediately the foreman down in the yards swung round and obeyed the order.

How did he hear it? By means of the new loud-speaking telephone that amplifies the ordinary speaking voice so that it roars out of the other end of the wire.

In the conference room there was one of the special "loud-speaking" transmitters. It was located about two feet away from the superintendent. When he turned toward it and spoke, the resulting sound-waves hit the diaphragm and thus caused the electrical waves to pass into the amplifying device.

The amplifier is provided with several valves that increase both voltage and power. By the time the electrical waves leave it they are enormously increased. They travel across wires to a series of receivers, all of which are equipped with horns similar to those used on gramophones. The diaphragms of these receivers are crinkled and thus stop the resonance that would create confusing noises; the voice rings out clearly and distinctly.

Any number of receivers can be used, and one small voice on the transmitting end will issue forth from them all. But the number of valves in the amplifier must be increased when more receivers are added.

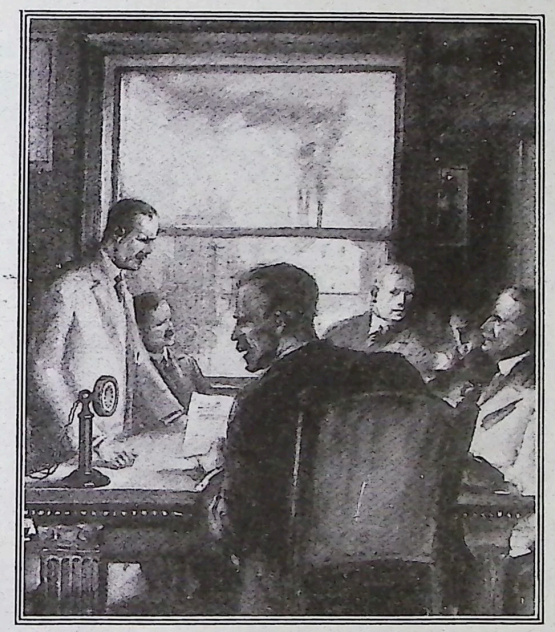
There are eight receivers in the yards of this particular electrical plant. They are so arranged that the voice on the sending end of the telephone can be heard distinctly all over the company's yards.

Recently, in Christiania, Norway, one of these receiving horns was erected outside of a large newspaper office.

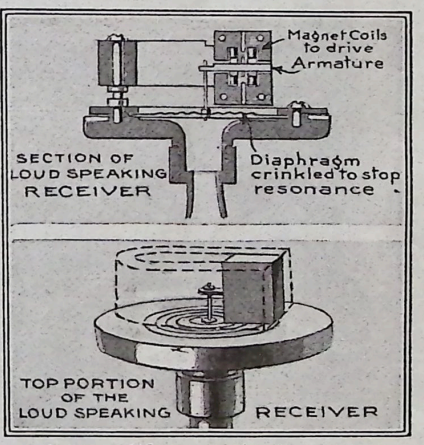
One of the reporters at the transmitting end was calling off events in a great skating-match going on at the time. This was for the benefit of the passers-by. But the passers-by were so interested that they stopped passing, and soon a great crowd had collected outside of the building. Traffic was held up and the city police were very much annoyed.

What would they do if baseball became the Norwegian national sport?

The superintendent used his speaking voice; yet the yards foreman heard him distinctly



The superintendent in the office saw the trainload coming down the tracks and by means of the loud-speaking telephone he warned the foreman



An amplifier greatly increases the volume of an ordinary speaking voice

Hauling in 2000 Barrels of Fish

A model of a huge fish-trap that is capable of bringing in from 1000 to 2000 barrels of fish at one time

DETACHED and disjointed, the sections of a gigantic fish-trap can be put together in half an hour. When complete, it measures 60 feet in diameter. The hoops which hold the net are 15 feet apart and 10 feet deep. Though the dimensions of the trap are large, it is easily manipulated, a crew of only six men being sufficient to handle it.

The trap is the invention of Fred P. Smith, of Chelsea, Boston. A haul of from 1000 to 2000 barrels of cod, pollack, herring, bluefish, mackerel, or any surface fish, can be caught in the net.

Fifth Avenue Twenty Years After

Fifth Avenue has long been New York's favorite parade ground. Twenty years ago, when women wore huge hats and tiny waistlines, they paraded up and down the avenue just as they do to-day

The picture shown above was taken on Easter day in the year 1900. The one at the left was taken recently. There is just one automobile in the large picture. Find it, if you can. The day of the traffic "cop" had not arrived

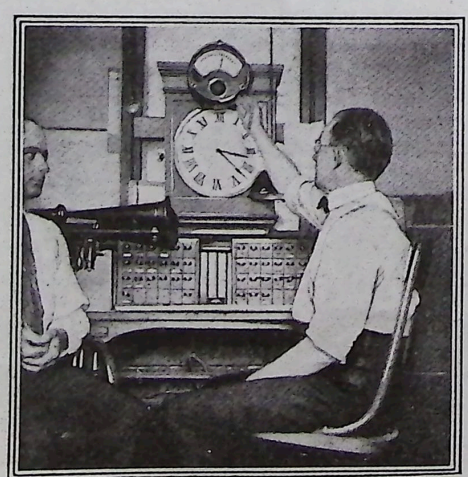
Regulating an Electric Railroad's Power

THERE is a new automatic power limiting and indicating system for electric railroads. The system is based on the desire to prevent excessive peak loads which might cause serious voltage variations.

It accurately records at one place and on one meter the total power supplied to the railroad's transmission lines at a number of points.

The illustration shows a train-despatcher's office with an indicating instrument above the clock. The function performed by this device is that of automatically limiting the maximum power demand and recording the total net power.

Regardless of the number of feeding-points, the dial indicates to the train-despatcher at all times the total net amount of energy being delivered to his division, with permanent record for future study. The controlling device automatically deducts regenerated power if it is returned to the power company's lines or transferred from one line to another over the railway company's transmission line.



That small dial over the clock registers the power in use on a complete railroad division

It will automatically limit the amount of power supplied to the division by lowering the trolley voltage and slowing down the trains so that the maximum peak load on the system cannot exceed a certain predetermined maximum.

The maximum limit can be changed instantly by the despatcher without the necessity of notifying substation operators.

What the X-Rays Reveal about Matter

The atom has a skeleton and the X-rays show its structure

A model of an atom. The balls show the positions of electrons. These positions are not guessed at; they are determined by X-raying different crystals in powdered form. In front of the model is the X-ray apparatus

WHEN the X-rays were first discovered, scientists were not quite certain whether or not they were light. Light, as every one knows, is a wave motion of the ether. X-rays have waves ten thousand times smaller than ordinary light waves. The ordinary prism or diffraction grating could not resolve an X-ray into a spectrum. A spectrum is due to interference of the light waves. There could be no interference with a diffraction grating because the lines could not be ruled closely enough.

In 1912 it occurred to the German physicist, von Laue, that perhaps the atoms in a crystal might act as a diffraction grating. They were certainly closer together than lines could ever be ruled on a plate. He made the experiment. He obtained an X-ray spectrum. It was established that X-rays are light rays.

Now the X-rays are produced by the bombardment of a substance, usually a metal, with what are called electrons. Every atom is composed of a nucleus and one or more electrons revolving around it. An atom, therefore, is a kind of solar system. Shoot electrons at a substance in a vacuum and X-rays are given off by that substance. A young Englishman named Moseley produced X-rays from every metal—from aluminum to gold. He made photographs of the X-ray spectrum of each metal. He proved conclusively that atoms are indeed built up of electrons, and that when, for example, the chemist said that aluminum consists of a nucleus around which thirteen electrons are grouped, it was true.

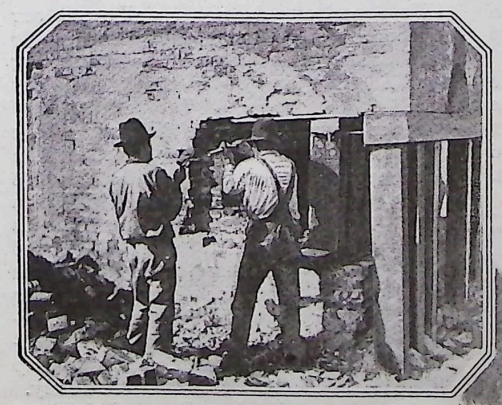
Moseley showed that what is known in chemistry as the periodic table—a table in which all the elements are arranged according to their atomic weights—is curiously related to the electron theory. Hydrogen is the first in the table. It has also the lightest atom. At the extreme end is uranium, which has the heaviest atom.

The numerical position of an element in the table is significant. Thus aluminum is thirteenth in the table. Moseley also proved that an aluminum atom consists of a nucleus around which revolve exactly thirteen electrons. Similarly, uranium, which is the ninety-second in the table, has ninety-two electrons revolving around its nucleus.

Continuing Moseley's work, the two Braggs, father and son, proceeded to determine the exact positions of the electrons in an atom by means of X-ray spectra. Their work, with an improved apparatus of his own invention, has been continued in this country by Dr. A. W. Hull, of the General Electric Company.

Thanks to the electron theory, physicists now know why oxygen combines with iron and not with some other metals; why some substances are conductors of electricity and others not, and why helium is inert, that is, does not combine with other elements.

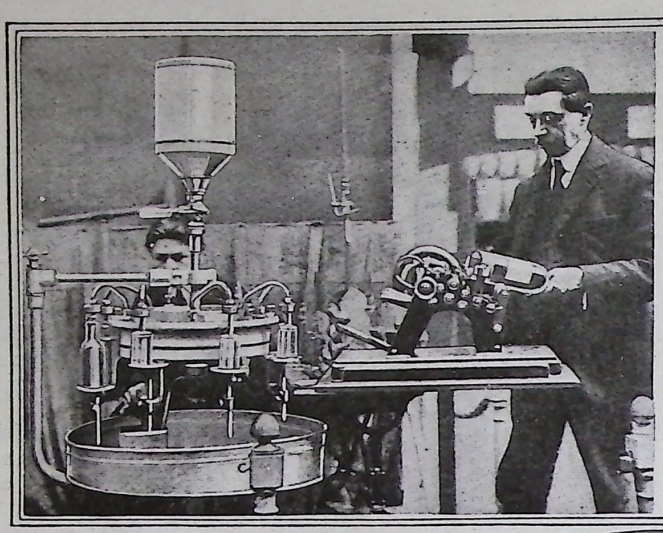
Down Came Eight Hundred and Fifty Tons of Brick



A shortage of buildings and of brick existed in Hilton, California. It was decided to raze an old chimney which contained eight hundred and fifty tons of brick—enough to relieve the brick shortage. A big notch was cut into the chimney's base. As the bricks were removed, supporting timbers were put in

Slowly at first, then with increased speed, the big pile of brick moved earthward. There was a great crash

When the timbers were all in place, they were covered with gasoline and set on fire. The men then gathered up their tools and drew away to watch the big crash from a safe distance. As the fire burned, the timbers became weakened; they groaned under the terrific weight, and—down she came!



A French Machine that Bottles and Labels

FROM France there comes a new quick-action wine-bottling machine. Frenchmen have plenty of use for it. They drink a bottle of wine with nearly every meal! The machine interests us only theoretically.

The wine is poured into a tank which looks like our orangeade tanks. It is shown at the left of the picture above. A pipe connects the tank with a vat beneath it, and a faucet controls the flow of the wine, and the wine in the vat remains at a constant level.

Eight siphons carry the wine from the vat to bottles which are placed on holders below. Special valves in the siphons regulate the amount of wine that goes into each bottle.

When the bottles have been filled, they are corked and labeled. The labeling is done automatically by a machine shown at the right. Parallel rollers revolve and release the labels.

Cracking Nuts with a Stick

WOULD you like to know a new way to crack nuts? This is not a joke, but a serious question.

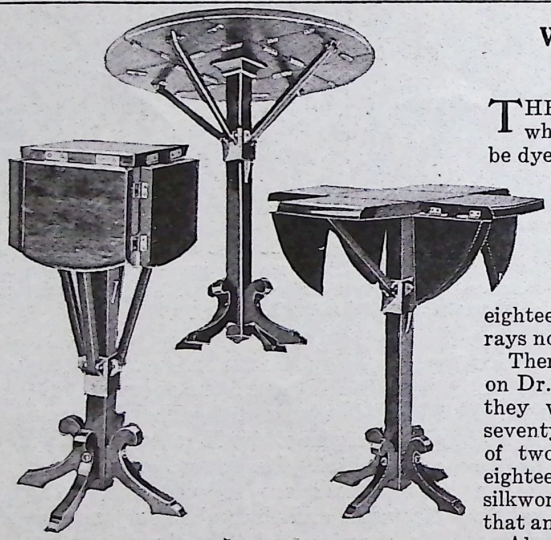
If you are out in the woods gathering nuts some day, and have no nutcracker with you, make one.

You take a stick and cut a notch in it. The notch should be about two thirds as deep as the average nut, and a little wider.

You insert a nut in the notch, press on the top of the stick, and your nut will crack. The meat will be intact and so will your fingers.

Soft-shell nuts can be opened in this manner, provided the material composing the stick nutcracker is of the right degree of toughness. It is something new, anyway.

If it does not work, try the nut with a rock, though it will not be as safe for the fingers as this stick suggestion has been found to be.



The Table that Collapses

A NEW folding table has been invented by Vernon M. Gay, of Danbury, Connecticut.

Opened up, it has an attractive circular top whose leaves barely give a hint that they are not built to be permanently spread.

Presto! The sliding clamp along the main support is moved, and down come certain sections of the leaves, making the table-top a perfect Maltese cross.

Then a slight manipulation of the clamps, and the whole top folds down in the form of a square box. The table then can be used as a pedestal; or it can stand inconspicuously in the corner of the room.

Worms that Spin Silk in Every Color

THE silkworm has no taste for color, for which reason its silk is drab and must be dyed before it is woven. By feeding the worm certain leaves it can be made to spin its silk in various beautiful colors.

Dr. Vartan K. Osigian, an Armenian, has developed this process, and the silkworms spin silk in eighteen different shades. Neither the sun's rays nor boiling will cause the silk to fade.

There are two hundred thousand worms on Dr. Osigian's farm at New Orleans, and they will turn out a cocoon apiece in seventy-two hours. These cocoons consist of two strands of silk, each containing eighteen hundred yards. The ordinary silkworm does not turn out anything like that amount.

Above you see Dr. Osigian feeding his worms with the mysterious leaves that have this effect. He comes from a long line of "silk kings."

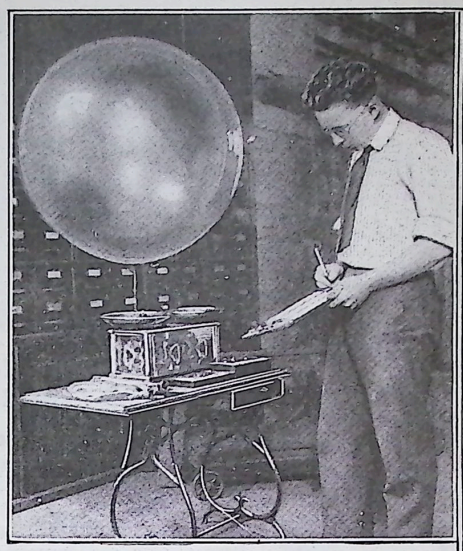
Mittens for the Athlete's Feet

ON each hand there are four fingers and a thumb; and on each foot there are five toes.

We Americans do not usually put our big toes in a class by themselves, as we do our thumbs. Thus the toe of our stocking is all in one, and so is the toe of our shoe.

But in Japan, ideas are different. The big toe is considered a thing apart and in consequence it is often isolated. To the left you see the legs of a Japanese athlete. On his feet he wears a pair of running-shoes which are made so that his big toes run by themselves. Perhaps this shoe construction enables him to grip the ground more firmly.

In spite of their short legs, the Japanese are fast runners and good all-around athletes. The average American's legs are more than half the length of his body. The reverse is true of the Japanese.



Weighing the "Lift" of a Balloon

FREE balloons of small size are used by the United States Weather Bureau to help in determining the conditions of the atmosphere and to aid the forecasts which are so valuable to aviation.

The drift of free balloons and the motion of the clouds are the weather-vanes of the upper levels.

It is important to test the balloons and to determine their lifting power. This is done by an expert making use of delicately balanced scales to which the balloon is attached. The counterweight necessary to balance the lifting power of the gas with which the balloon is inflated, furnishes the required information.

Balloons of larger size equipped with recording instruments are used to make soundings of the upper atmosphere.

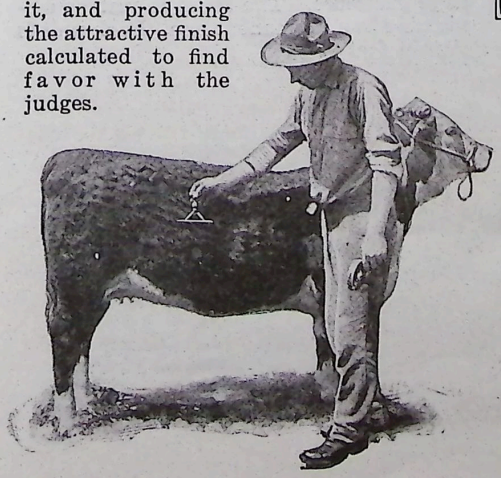
Hair-Dressing Styles for Cattle

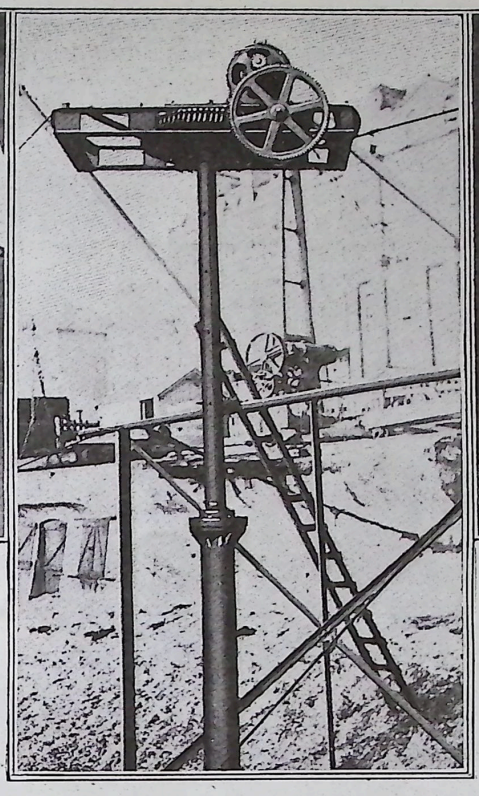
LONG-HAIRED breeds of cattle, such as Hereford, Galloway, or Angus, are carefully "frizzed up" before they are taken into the show ring of the exhibition.

Sponge baths and daily scrubbings with soap and water, and much brushing, get the hair in condition for final treatment.

Just before Bossie goes into the tan-bark arena, the attendant moistens her coat with a mixture of olive oil and denatured alcohol which makes the hair lustrous and fluffy.

He then brushes and parts the hair, carefully using a round curry-comb for curling it, and producing the attractive finish calculated to find favor with the judges.



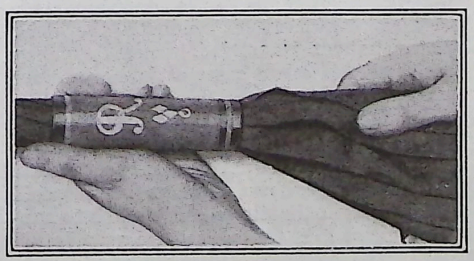


A Pile-Driver that Does Not Drive

IF machines like this one are used, the "bump, bump, bump" of the pile-driver will no longer be necessary.

This driver screws steel piles into the earth. It works silently but efficiently, putting a steel pile in place as quickly as the ordinary pile-driver.

The end of the pile is provided with crude cutters and a single screw-thread. The cutters bite into the earth and the screw-thread causes the pile to follow them. The pile is bolted to the driving-rod of the machine, which is turned by an electric motor connected to it through a train of gears.



Roll Your Umbrella by Tube

EVER try to roll an umbrella smoothly so it will not bag in the center? The man who knows takes from his pocket a small aluminum cylinder lined with leather and having upon it a gold monogram. Into the end of the cylinder he places the point of the umbrella, holding the cylinder in his left hand. Rolling the cloth in compact folds is now a simple matter.

The difficulty of hand-rolling is to keep the folds under even pressure and not to let them become loose before the top of the cover is reached. By making use of the "roller," the cloth is held rigid enough to assure even rolling.

Farmers Become Experts at Grading Grain

"WHAT is the quality of your lot of grain?" is a question that must be answered. The mass must be probed and a sample taken out to be graded. It is necessary to obtain equal portions of this sample.

The Department of Agriculture has put forth an invention which any one can make.

It consists of a metal cylinder, at the top of which is a container for the grain, poured in by a funnel. The bottom of this container is closed by a cap manipulated by a lever.

Pull the lever and the grain flows over the sides of a cone. Part of it pours into chutes which convey it into the pan at the bottom. An equal portion flows between the chutes and drops into a pan.

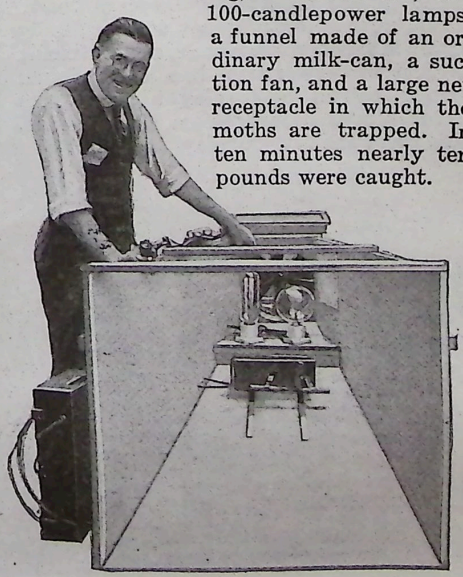
In this manner the sample of grain is exactly divided, and the test can be made.

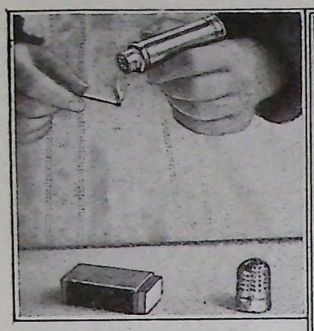
No Bugs in the Movies

THOUSANDS of dollars' worth of damage has been done by moths spotting the films during the making of moving-pictures at night.

A special trap has been invented by F. S. Mills and Clyde Ewing of the Hollywood Lasky Film Studio.

The device consists of a wide box opening, a carbon arc, two 100-candlepower lamps, a funnel made of an ordinary milk-can, a suction fan, and a large net receptacle in which the moths are trapped. In ten minutes nearly ten pounds were caught.





Carrying Heat in the Coat Pocket

WITH one of these little hand-warmers in your pocket, you need not fear the biting winter cold which threatens to benumb your fingers.

Take the hand-warmer, a cylindrical box of nickel, out of your pocket, remove the cover, strike a match, and light the wick soaked with the benzine with which the box is filled. Then replace the cover and the trick is done.

The interior of the cover is lined with a coating of a metallic substance which glows and gives out considerable heat when it is exposed to the vapor of benzine. The metallic lining of the cover will continue to glow and to give heat for about eight hours, or until there is no more benzine vapor.

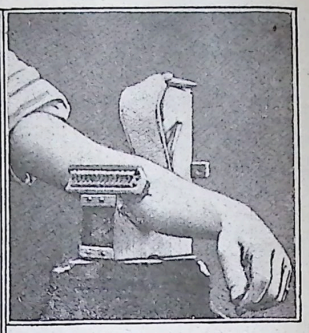
She's Practically Unsinkable

THE *Brude* is the latest approach to an unsinkable lifeboat which combines the capacity advantage of a raft.

Forty-four people, twenty on the deck and twenty-four on the continuous seat running around its sides, can be accommodated.

In a compartment beneath the deck water ballast is carried, while buoyancy tanks are arranged around the boat under the continuous seat.

On the upper deck, or roof, thirty extra people can be carried, making the capacity of this lifeboat equal to that of a raft. As the picture shows, the *Brude* is ellipsoid in shape and is built to carry a sail to supplement or take the place of oars. In the near distance is seen a complete view of this craft sailing.



Washing-Block for the One-Armed

HAVE you ever wondered how you would manage if you had only one arm?

The accompanying picture shows a German invention. It is a washing-block for the one-armed. It may be fastened to the wall of the washroom or clamped to any convenient piece of furniture when traveling.

A band of loofah covers a semicircular curve in a block.

Beside the block there is a small scrubbing-brush fastened. The loofah is dampened and rubbed with soap. The arm and the hand are rubbed against the loofah and the brush, and can then be rinsed off under the faucet or in a bowl of water. Then the loofah band is removed and a strip of toweling is put in its place.

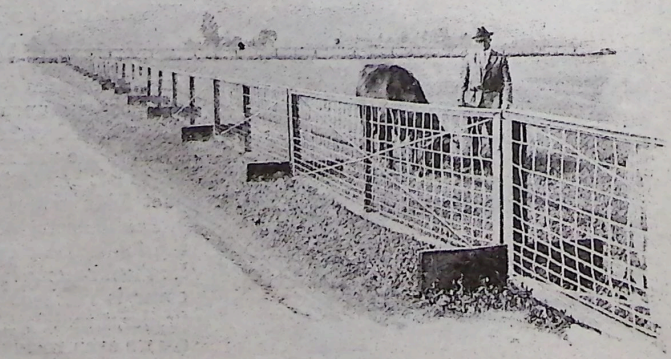
Primitive Styles in Automobiles

IN the early days of the automobile, each new type was larger and more complicated than its predecessor. Electric-lighting systems, new kinds of steering devices, ammeters, oil-gages—one by one, they were added.

And now, after twenty years of automobiling, we find the small, simple car in vogue again. Below you see a "new" Dutch automobile. It has a one-cylinder engine in front, three wheels, and a steering apparatus very much like the original ones. Instead of turning a wheel, the driver moves a lever from side to side. This was done twenty years ago.

No Stakes or Nails Needed Here

ANY place is home-sweet-home to this fence. There has always been a great need for a fence of this nature and at last an enterprising inventor of Palo Alto, California, set about the task of developing one. The result of his labors is shown. In erecting this fence it is not necessary to drive stakes or nails. The units hook together and they are prevented from falling by cross-pieces mounted at right angles to their length. The units are light and can be readily transported from place to place. A single truckload is sufficient to make a large enclosure. The fence is just as serviceable as a permanent one. Each unit is sixteen feet long.



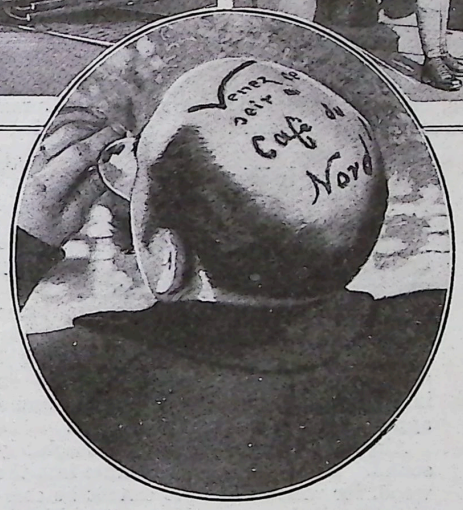
© Underwood & Underwood

Is This a Street-Car or Is It a Cage?

HERE is a street-car that looks something like the monkey-cage at the zoo. In fact, this car would make a very suitable vehicle in which to transport monkeys. Few changes in its construction would be necessary.

This car is one of many equipped in the same way for protective purposes. During the recent strike of the men on some of New York's great subway and surface-car railway systems, it was decided to place this protecting screen on every car to prevent injury to the passengers should the strikers get rough. Before the strike was over, the screens proved very useful and saved many a broken head.

As a further precaution, two policemen were placed on each car, one at the entrance and one at the exit. Although these precautions minimized the danger of accident, they did not prevent it altogether.



It Pays to Advertise

"I SCENT which pays the best, an' then, go into it bald-headed." So saith the poet, James Russell Lowell.

The same sentiment was held by the bald-headed man above; he scented advertising. Whereupon the words, "*Venez ce soir au Café du Nord*" (Come this evening to the Café du Nord), were painted on his bald head and he sat every evening on a boulevard in Paris near the café. The proprietor paid him well for his advertising space, which is one time that a bald-headed man had the advantage over his shaggier brother.

Water, Only Five Cents a Glass

YOU who let the water drip for days because you are too lazy, or busy, to repair a broken washer, take note.

In Constantinople folks must pay five cents for a glass of water! Above you see an army officer getting his nickel's worth.

The water supply in Constantinople, however, is gradually being increased. The use of cisterns has been almost entirely abandoned. Instead, water is piped from reservoirs in the forest of Belgrade to vaulted chambers in the city from which it is distributed to fountains all over the city. Water-carriers supply the various houses.

It is peculiar to note that nature does not always place water where it is most needed. In more torrid regions of the world water is not as plentiful as in the United States. It causes one to wonder what happens at a fire.

To Warn of Unseen Danger

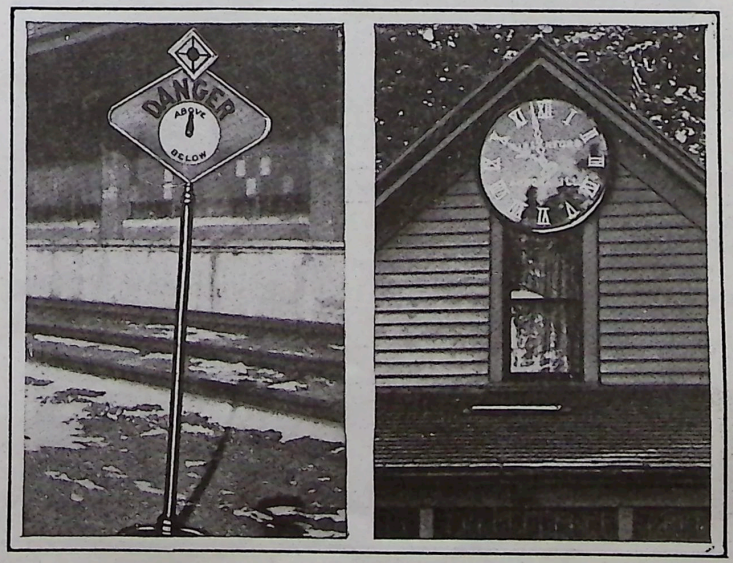
THERE is a new danger-signal that warns you whether a monkey-wrench may fall upon you from above, or a manhole cover blow up and hit you from below.

The signal is provided with an arm that points either up or down toward the source of possible danger.

It was invented by Kenneth P. Babcock, who is a safety engineer of Springfield, Massachusetts. He calls attention to the fact that it is the unseen source of danger that is the deadliest—in other words, the one above or below the range of vision.

The indicator is turned to register either "Above" or "Below."

The indicator circle is white and all the remainder —lettering, indicator, and pipe — is painted black. The entire signal is five feet tall.



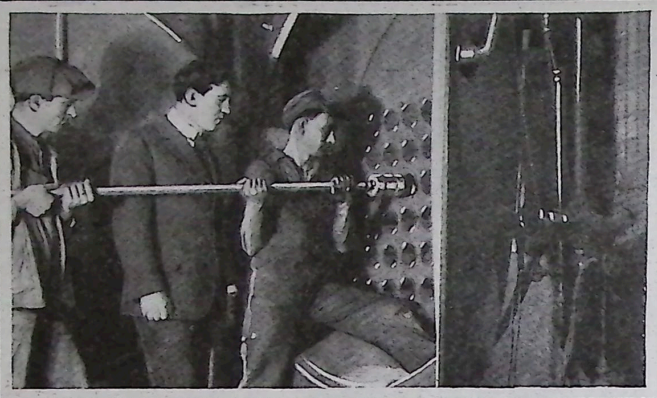
A Most Extraordinary Clock

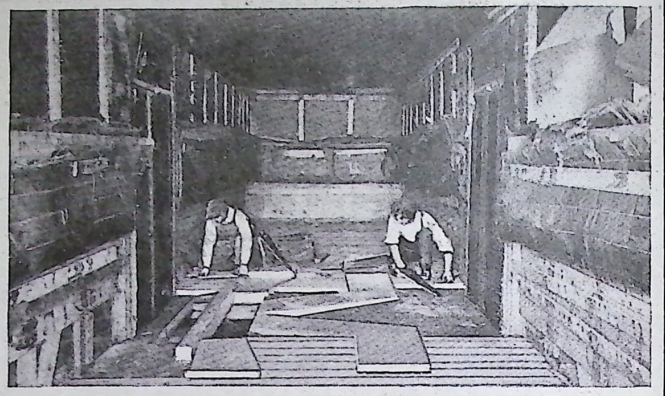
PLAIN and simple as this clock looks, it is really very complicated. Not only does it tell the time of its own home town, Aurora, Illinois, but upon request will tell the time of places all over the world.

It also gives astronomical and atmospherical readings, and has thermometer and micrometer attachments. It is wound every two months by two fifty-pound weights.

The clock was made by a man named Blanford; he spent most of his life working on it. When he died, Aurora bought the clock, and installed it in a conspicuous place.

The workmanship in the clock is of the best, and the future citizens of Aurora for many years hence can expect to find it running, and by it they can order their lives from day to day as their ancestors did before them.





This Tool Shakes Scale from Boiler Tubes

IF boiler tubes are made to vibrate at a high frequency, they will shed their scale as a duck's back sheds water.

This little tool climbs into a boiler tube, carrying its flexible feed-pipe after it. It obtains its power from steam or compressed air.

When the steam or air is admitted to the tool, its "vibrator head" gets busy and vibrates rapidly. This vibration is imparted to the boiler tube and the scale is shaken off. The accumulated matter on the inside and the outside of the tube is forced to leave.

The vibration of the tool is very mild though effective. It can be held in the hand with perfect comfort while it is vibrating at high speed. This makes it possible to use the tool with no fear of its harming the tubes of the boiler in any way.

This is one of the most effective methods of removing scale cheaply and without danger to the tubes.

Through Wood with X-Rays

RONTGEN rays penetrate wood with the greatest ease, and it is possible to detect imperfections so small that they ordinarily would escape notice.

Samples of wood from which airplane spars are to be made are planed perfectly smooth, and the grain is seen to be straight and even. But if there should be an internal knot, shake, or crack, it would appear distinctly in the radiograph.

Airplane parts must be absolutely sound. The eye cannot penetrate into the wood, for which reason it cannot be completely relied upon. Hence the X-rays must take its place.

Paper-Lined Cars Are Frostproof

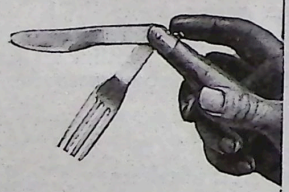
HOW can potatoes be shipped by railroad in cold weather without their freezing? Experts in the Department of Agriculture's Bureau of Markets considered the subject and came to the conclusion that paper would do the job as well as anything.

Paper is a good insulator. Both extreme cold and intense heat fail to affect it greatly. That's why, in winter, people wear paper in their shoes, and wrap themselves in paper vests.

But a paper vest for each potato would not be practicable.

What to do then?

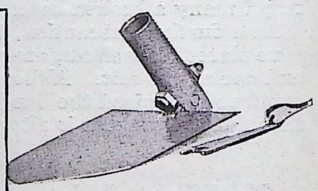
Why not line with paper the cars that carry the potatoes? Place a thick layer of paper on the floor and fasten planks over it. Do the same to the ceiling and the sides of the car. The car will then be well protected from outside drafts of cold air, and the potatoes placed within will reach their destination untouched by the frost.



A One-Handled Knife and Fork

A KNIFE and fork that folds up like a jackknife has been invented by Rudolf Stroppel of West Branch, Iowa. The inventor tells us that it is intended for people with one hand and "campers, or others in like situation." By this, we judge, he means travelers of all kinds who may desire a quick meal on the road.

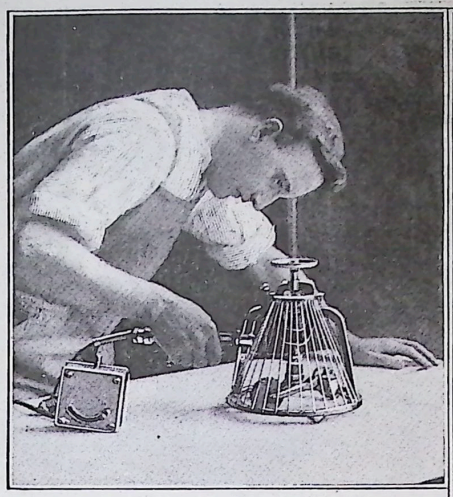
When the knife and the fork are opened up, they are sufficiently far apart not to interfere with each other. To close them up, you press a button in the handle. But when the fork is laden with food and is on its way to your mouth, take care that you do not press the button.



Make the Shovel Into a Hoe

WHY not combine the hoe and shovel into one tool? The hoe digs down and the shovel digs up; thus one blade will serve both purposes if its direction can be adjusted and its shape can be modified to suit both operations.

Mr. Joseph Szabo of Newcastle, Pennsylvania, has invented just such a tool. The blade is flat and yet rounded at the end. It swings at the end of the handle and can be fastened into either the hoe or shovel position by means of a small wrench, which is shown beside the shovel in the picture above. The tool can be used for heavy farm work and for light garden work.



A Pattern that's Already Laid

AS the high cost of clothing is due largely to the high cost of labor, any labor-saving machine is welcome. Above you see an electric pattern-marking machine that does the work of many skilled men.

When a certain pattern is decided upon and laid out so that the least possible amount of goods will be used, the new marking-machine traces this pattern on a sheet of chemically prepared paper.

As the machine passes over the paper, it makes perforations in it at the rate of from three hundred to three thousand a minute, depending upon the speed at which the machine is operated. There are seven speeds to choose from.

The paper chart thus made is placed over the cloth to be cut and white powder is dropped on it. It goes through the perforations and leaves a white trail on the cloth below.

How You Can Tell if Cement Is Waterproof

SOME cement is waterproof, and some is not. But you can't tell by looking at them which is which.

If you wish to find out, sprinkle some of the cement on top of a glass of water and then thrust your finger into the water. If the cement contains the proper amount of waterproofing material, your finger will be dry when you pull it out of the water.

A New Use for Talc

BARIUM sulphate, like many other things, is very scarce. It has always been used as a filler in paint and now a substitute must be found.

Many paint manufacturers have decided to try using a talc which belongs remotely to the same family as the talcum powder you use.

For years talc has been considered greatly inferior to barium sulphate, but now that actual tests of it are being made, its reputation has begun to improve. Although talcs from different localities vary both in physical appearance and chemical content, their differences become unimportant when they are ground very fine.

Lifting Men with Kites

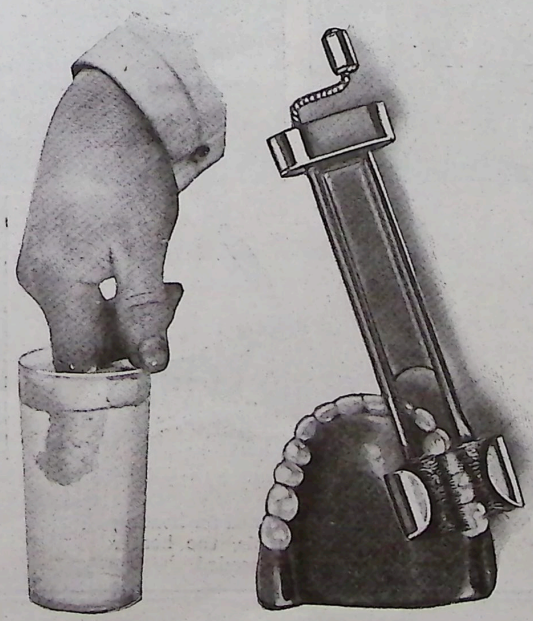
WHENEVER you have an irresistible desire to go up in the air, try kiting; that is, ascending by the aid of man-bearing kites.

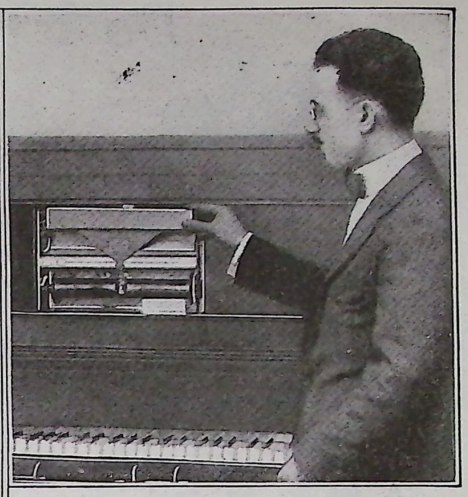
You will be sure to find it a decidedly exciting and exhilarating sport.

Kiting of that kind is a favorite pastime in France and there are numerous clubs devoted to this sport, which have formed a general organization, known as Union Cerfvoliste de France, the headquarters of which are at Issy les Moulineaux, on the outskirts of Paris.

Large kites, stoutly built, and of carefully tested material, are sent up in tandems of two or more, held by a wire or light cable.

Two kites that have an aggregate surface area of about 140 square feet will support the weight of a person of about 140 pounds, provided the wind has a velocity of at least 28 or 30 feet a second.





The Box that Won't Come Off

GREIG'S "Morning Mood." That's the name you see on the box. You take out the music-roll, adjust it in place in the player-piano, and start working the pedals. But the first bar or two tells you that "you've come to the end of a perfect day."

Of course it's a mistake. Somebody put the music-rolls back into the wrong boxes. That's why you got the end of the day instead of the beginning.

How can this be avoided? By never taking the rolls out of the boxes. If the boxes are made smaller and the ends of the rolls are allowed to project out of them, these ends can be engaged with the spindles of the piano, as usual. Of course the boxes must not interfere with the rotation of the rolls.

A Tooth-Brush that Twirls as It Cleanses

IF you brush your teeth regularly three times a day and do it thoroughly, you need not fear the dentist's chair. But what kind of brush is best for teeth? Owing to their peculiar irregular formation, it is difficult to construct a brush that will reach all the hidden corners and crevices. Some dentists advocate large brushes; others favor small. Some think they should be curved; others say they should be straight.

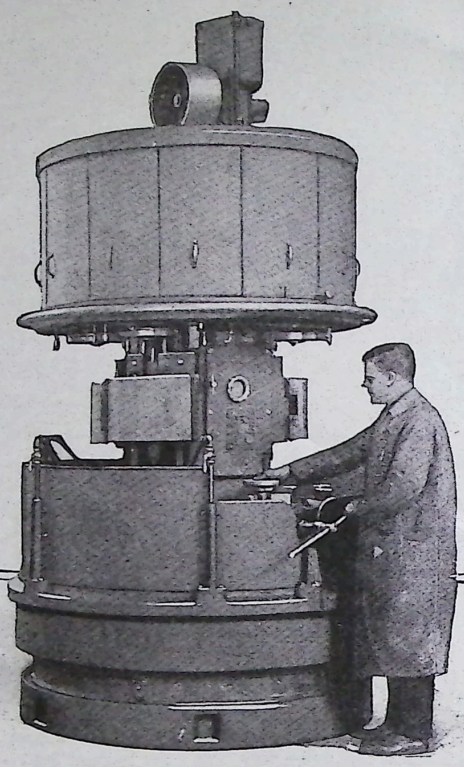
And now we have a rotary tooth-brush.

It was invented by Mr. Jacob Goldstein, of West Hazleton, Pennsylvania, who has long rebelled against them all. This new tooth-brush consists of two small circular brushes that are made to rotate by means of a handle located at the end of the implement. The brushes are parallel and the space between them is sufficiently large to admit a row of teeth. When you turn the handle, the brushes rub against the teeth and are able to touch the seemingly inaccessible spots.

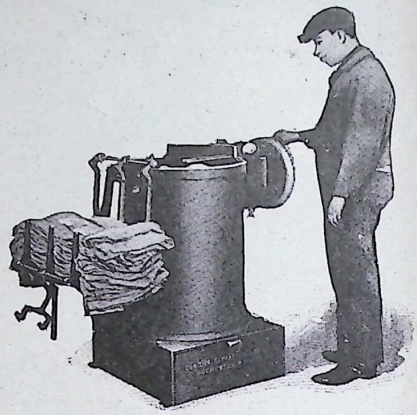
Of course when the brushes rotate, the tooth-paste and water on them tend to fly outward—as in the case of snow on a snow-plow. But to avoid this, each brush is equipped with a sort of mud-guard. Thus the pasty water is retarded in its flight, and can be removed when the cleaning is over.

Do It with Tools and Machines

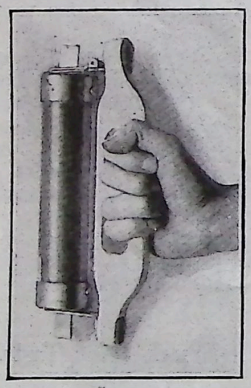
A one-man high-speed ball-bearing jack. He shifts the lifting lever into sockets provided for the purpose, tips it over on its own permanently attached wheels, rolling it where needed



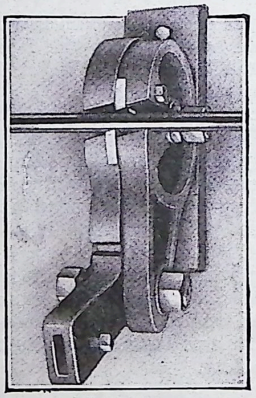
This machine is a whole factory in itself. It performs five different tooling operations on the same piece. One man only is required to operate the machine and his task consists in feeding the rough work and removing the finished article



This machine removes by vibration any cement left in the bags. The bags are also baled and counted before removal from the machine. Both time and money are saved by its use



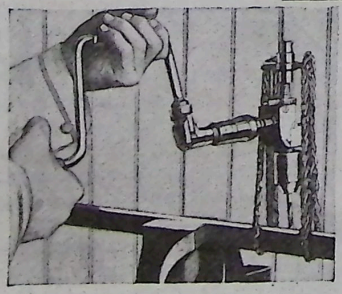
The removal of fuses from high-voltage circuits is risky work. If a porcelain handle is attached to a large fuse, it can be removed without danger to the workman



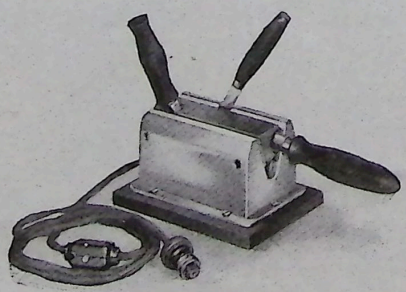
The air-driven blower is something new on a forge. All the blacksmith has to do is to regulate the flow of air instead of pumping the bellows

This jig automatically clamps and ejects work, requiring hand-feeding only. It is operated by the foot. A short action clamps down the part to be drilled

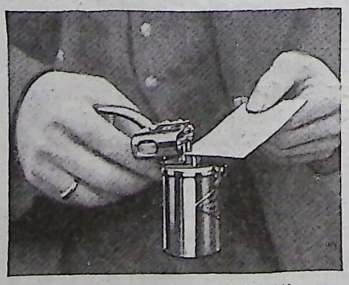
In building operations in which reenforced concrete is used, it is necessary to cut the reenforcing rods of iron. This cutter will cut such rods any length



By attaching a carpenter's brace to this apparatus you can easily drill holes in steel. The chains keep the drill tight against the steel that is being worked



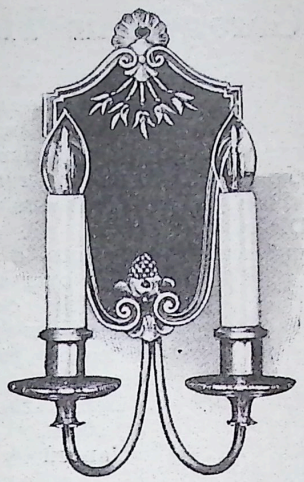
An electric heater designed for heating shoe-manufacturing tools, the heater keeping them hot until needed



The conductor's punch clips a hole in the commuter's ticket, and the piece falls into the container. Punching the ticket registers the fare

Housekeeping Made Easy

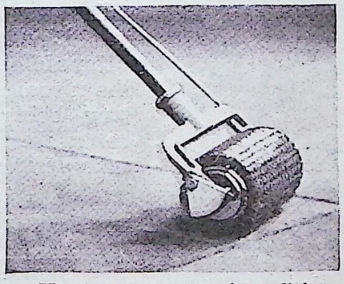
Here are various devices to save energy and obtain better results



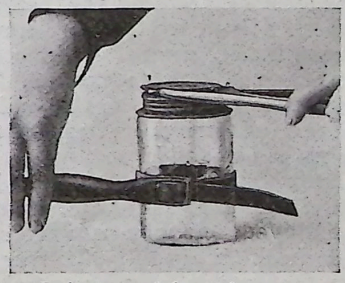
Candles are popular because of their beauty, but the light they give is insignificant. If the candles are placed in front of a mirror, as is the case in the fixture above, the candlelight should be doubled because of the reflection

When it comes to rubbers, we are as bad as the naughty kittens who lost their mittens. A strip of rubberized material attached to the inside of each rubber will keep them fastened together; it fits inside the rubbers when not in use

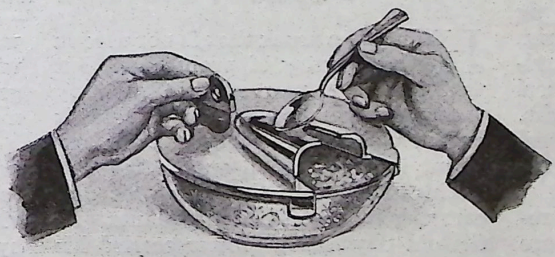
Curling-irons and hot-water bottles usually haven't much in common. But an iron whose handle is detachable will heat the water in a bottle by inserting the rod in the bottle and turning on the switch



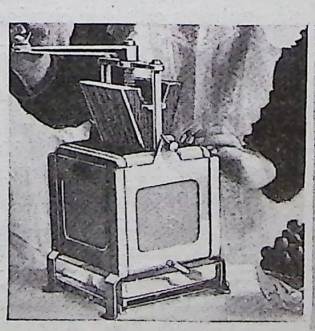
You can preserve the polish on floors with this device. You wrap a cloth around the circular brush and mop up the dust. Then you use the brush for polishing. You lock it in a certain position until the exposed bristles become dull; then you change it



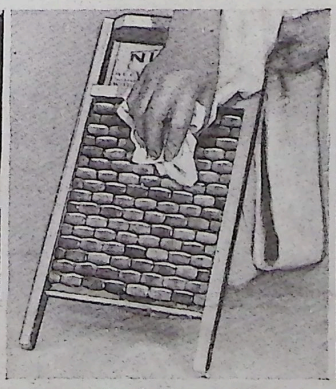
It is essential to have an airtight cover on a jar of preserves. Two new cover wrenches are shown above. The one which grasps the jar has an adjustable tape band attached to a metal handle. The wrench that grasps the cover is all metal



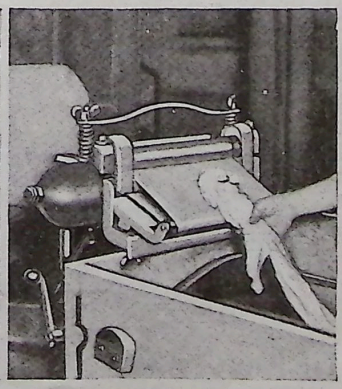
When you dig into a grapefruit, you're almost sure that some juice will find your eye. Put a cover over the fruit, and you'll be safe



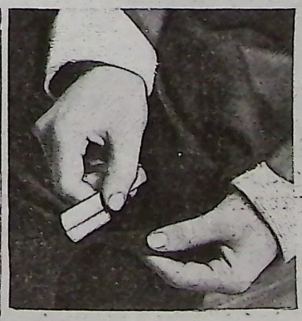
She's crushing grapes. The machine is a porcelain-lined box and a wooden wedge that is forced down by a handle. The grapes are crushed between the wedge and the container



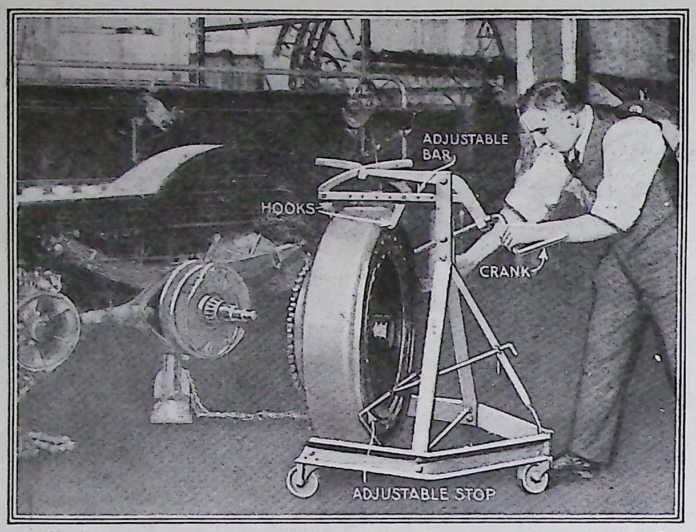
A usual rigid washboard wears out the clothes rapidly. But a washboard made up of small wooden rollers is much more merciful to them



Feeding clothes to the wringer by an endless belt-conveyor will save your hands and insure smooth feeding



Here is a safety seam-ripper. An ordinary razor-blade fits in a tooth-edged cover to which a handle is attached. As the blade cuts, the teeth guard the cloth and pull out the threads



One man can mount and dismount a large motor-truck wheel with the aid of this new crane, accomplishing the job with speed

To Mount Heavy Truck Wheels

THE problem of mounting and dismounting heavy motor-truck wheels has become more and more serious to the motor-truck owner as the size of his fleet increased, making the operation more often necessary for re-tiring the wheels or greasing the bearings. But the problem has been solved by the development of a special wheel-lifting crane by means of which one man can remove or mount the heaviest truck wheel. The crane is adjustable for any size of wheel or tire and special grab-hooks are furnished for removing wheels fitted with giant pneumatic tires instead of solids.

When the truck has been jacked up, and the hub-cap, axle-nut, and bearings removed, one man rolls the crane to the wheel. The grab-hooks, reaching under the fender, grip the steel rim on either side. A turn of the hand-crank, and the crane lifts the wheel so that it hangs free and straight. The crane and the suspended wheel are then rolled back from the truck, and the wheel is off in no time.

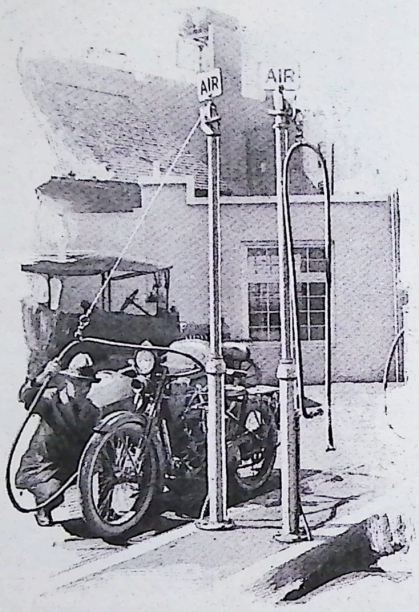
When the wheel is ready for re-mounting, the crane and wheel are rolled over to the axle. The wheel is slipped into place with one motion, the grab-hooks released by a turn of the crank, and the job is done.

All that the operator has to do is to set the grab-hooks, turn the crank, and roll the crane on its casters. The grab-hooks are set to the proper width by an adjustable splice-bar. They take hold as do a pair of ice-tongs—the heavier the wheel, the tighter the grip. A simple adjustable stop-bar at the base holds the wheel in a vertical position so that it may be slid over the axle spindle, even when a sprocket or brake drum would otherwise tend to slant to one side.

Protect Your Garage Air Hose

BECAUSE all motorists are human, and therefore often negligent about coiling up an air hose so that it will not be run over by other motor vehicles, walked upon, and eventually made to leak, the Standard Oil Company of California has developed an underground counterweight system of hose protection at one of its service stations in San Diego, California.

The underground counterweights operate a steel cable over a pulley, the outside end of which is attached to the air hose. The weight of the hose is slightly overbalanced by that of the counterweight, so that when some one has finished inflating a tire, the hose is immediately drawn up out of the way.



This hose automatically pulls up out of the way when not in use

The hose is thus kept out of danger. No one has a chance to walk on it, run over it with an automobile, etc. The moral of the story being that the hose has a much longer life.

From Vineyard to Bottling-Plant

HERE is a truck that is not used in the country of prohibition, but that marks a new step in highway transportation in France, where it has displaced the hand-cart, the ox-team, and the small wagon for collecting wine from the vineyards and carrying it to the bottling-plants. In the old days, each grower carried his own wine to the bottling-plant. This was slow and tedious work and likewise expensive. It also took the grape-grower away from his vineyard, which meant a decreased production.

Now with the motor-truck tank the grape-grower can produce more because he does not have to leave his vines. It is cheaper to collect the wine by truck because of the greater volume handled at one time. The tank on the truck holds 1600 gallons, in addition to which 800 gallons can be carried in a tank on a small two-wheeled trailer.

The apparatus is ingeniously worked out. The wine is pumped into the glass-lined tanks by means of a special pump mounted on the truck frame directly back of the driver's seat and driven by power from the truck engine.

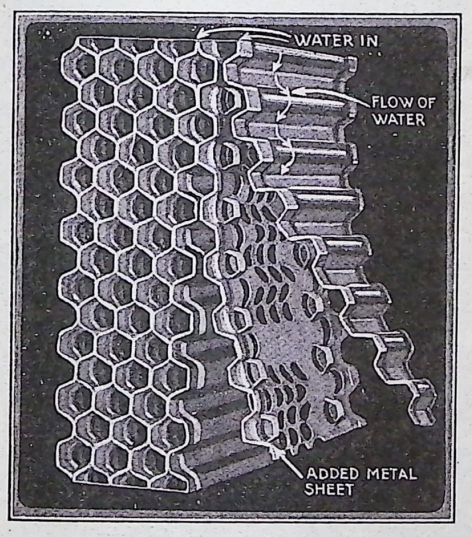
There are four suction pipes, two on each side of the truck. When these are not in use, they are raised from the ground by means of telescoping pipes. When in use, they are simply dropped into the barrels of wine on the ground.

Instead of water, this truck collects wine from the vineyards. It couldn't be used in this capacity in America, but France still presses the grape

An Automobile Radiator Shreds the Air

A NEW principle in the construction of automobile radiators shows the air passing through the radiator core shredded or broken up into a multiplicity of small currents.

The purpose of this division of the air-stream passing through the radiator is to bring the greatest possible volume of air into contact with some portion of the core and thereby absorb a greater amount of heat from the water to be cooled. In the ordinary honeycomb type of radiator, the air passing through each cell touches the core around the circumference, but allows the air in the middle of the stream to pass through without taking its share of heat from the water.



Air passing through the radiator is broken up into small currents which carry off much heat

© Goodyear News Service

Gaston Chevrolet, smiling and hopeful before the five-hundred-mile race

After six hours at the racer's wheel, when fatigue left him almost helpless

What Fatigue Poisoning Does to Us

WHEN Gaston Chevrolet swept across the finish-line, winner of the five-hundred-mile International Sweepstakes automobile race at Indianapolis last May, the spectators cheered wildly and marveled at the endurance of the plucky little driver who had sat at the wheel for six solid hours.

They did not see him climb feebly from his seat and, supported on either side, walk with head drooped, eyes "dead," and faltering step, to his garage, his face haggard from the fatigue of the long grind. They did not see attendants vigorously rub knotted muscles, cramped from the strain of gripping the tugging, jerking wheel for six hours.

That agonized expression which intermittently swept across his visage, the lifeless stare, made him look like a man who had just taken poison. And that is exactly what had happened.

Extreme physical fatigue is equivalent to poison, and, furthermore, fatigue poison is just as effective in its action as arsenic or carbolic acid.

"The extreme exhaustion suffered by Chevrolet caused certain chemical changes to create poisonous decomposition in the muscles of his body; in other words, the production and accumulation of waste substances such as carbon-dioxide and lactic acid," declares Dr. Clyde Leeper, of Akron, Ohio. "These in large quantities become known as fatigue poisons. They are carried throughout the entire body so that the exertion of one set of muscles leads to complete exhaustion of the entire body."

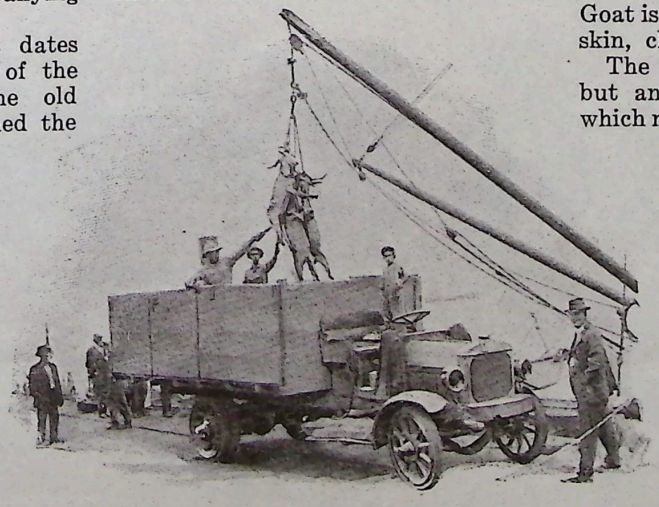
Getting Their Goats with a Truck

IT is not every day that a motor-truck can act the rôle of a goat-getter, although this is exactly what the truck shown in the accompanying illustration does.

Just how this came about dates way back to the early days of the eighteenth century when the old Spanish Mission padres searched the Pacific coast for converts.

When they sailed away from Guadaloupe island, about three hundred miles from San Diego, California, some of the more adventurous goats that strayed from the fold were left behind. Between that time and now, they have multiplied by thousands so that today they are being brought into San Diego on cattle-boats in lots of a thousand or more.

Once the boat is docked, the truck assumes its rôle of goat-getter. The goats are unloaded from the ship in groups of three or four by a steam windlass. The ropes are fastened around the horns of the animals, which are loaded directly into the truck body and then trucked off to the slaughter-house or the nearest railroad shipping point. Eventually Mr. Goat is converted into fertilizer, sheepskin, chamois, glue, and buttons.

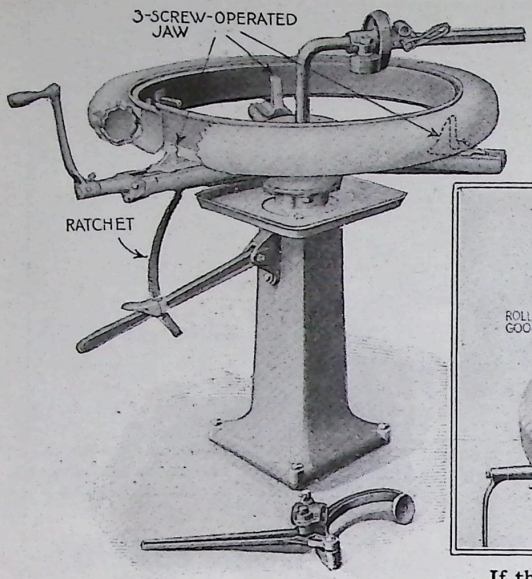


When all is ready, the signal is given and up go somebody's goats to be lowered into the truck awaiting them

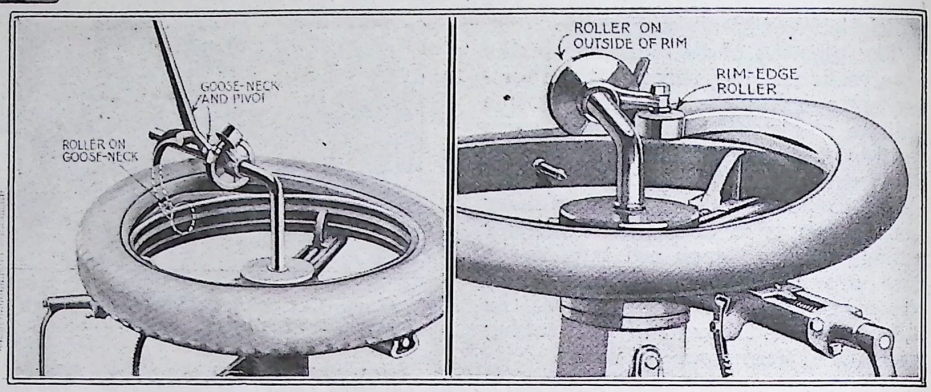
The use of trucks as goat-getters is but another of the unusual tasks to which motorized equipment can be put to good advantage. Before the trucks were used to carry the goats from the boats to the slaughter-houses and railroad sidings, the animals were driven through the streets. This was a slow and expensive process. It required a large number of men to watch each herd so as to prevent any of the goats becoming detached from the main group and wandering off and becoming lost. The goats are moved quickly by truck.

Doing Things Mechanically

The less handwork in the garage

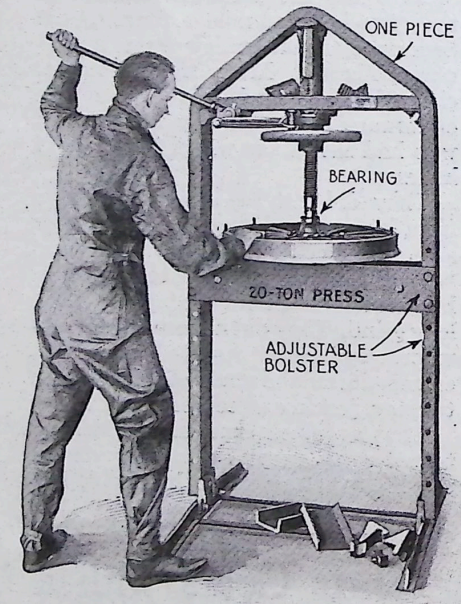


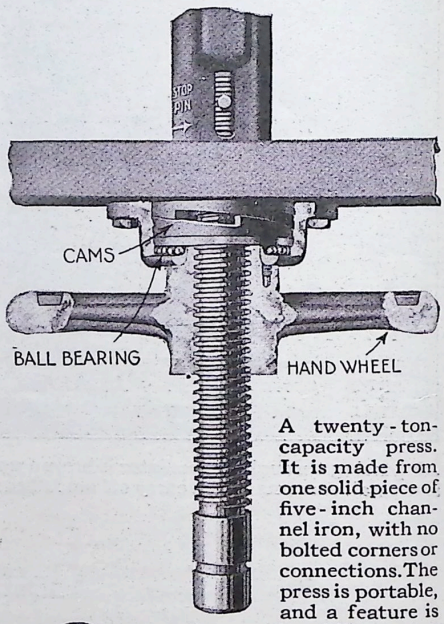
Above is a tire tool recently put on the market which quickly changes tires on all sizes and types of demountable rims either of the solid or split rim design. A glance from left to right across these two pages will illustrate how the machine is made to do various kinds of tire work economically and quickly



If the tire is stubborn after the lock-rings are removed, rotate the horizontal arm that carries the gooseneck

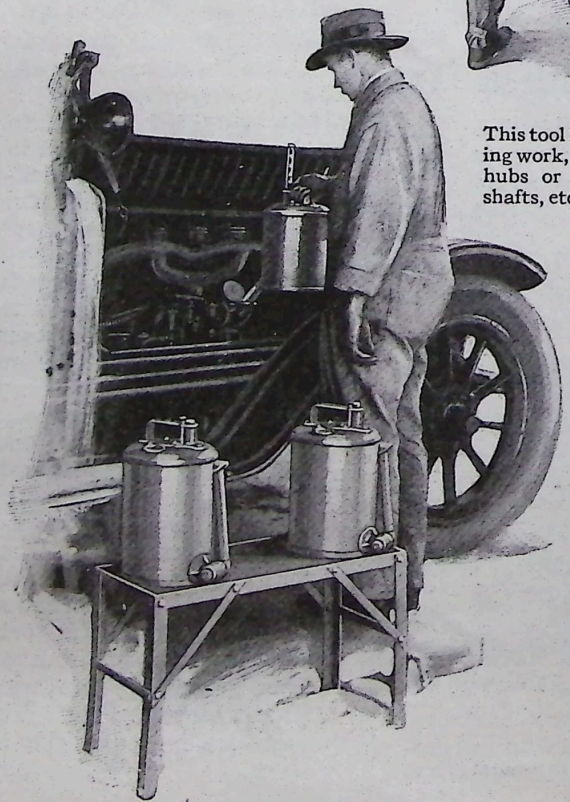
Mounting plain clincher tires on solid rims is made easy by using the horizontal arm with the rollers



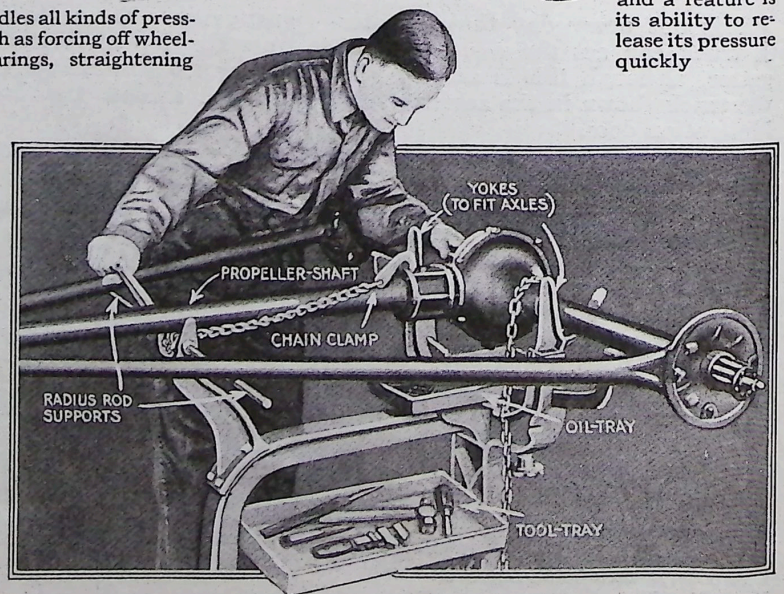


A twenty-ton-capacity press. It is made from one solid piece of five-inch channel iron, with no bolted corners or connections. The press is portable, and a feature is its ability to release its pressure quickly

Place this stand beside the gasoline filling station, and it is only a minute's work to deliver a quart of oil to the car needing it. This mechanical oiler keeps the oil clean and free from grit, which cannot be said of the open measure



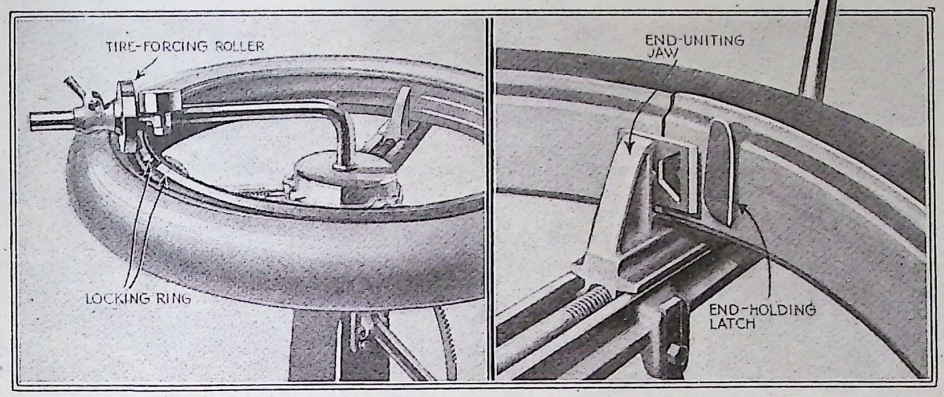
This tool handles all kinds of pressing work, such as forcing off wheel-hubs or bearings, straightening shafts, etc.



One man can handle unwieldy rear-axle assemblies with this tool. It consists of an axle-stand with two adjustable yokes for the live axle-shafts, and a bar support for the front end of the propeller-shaft

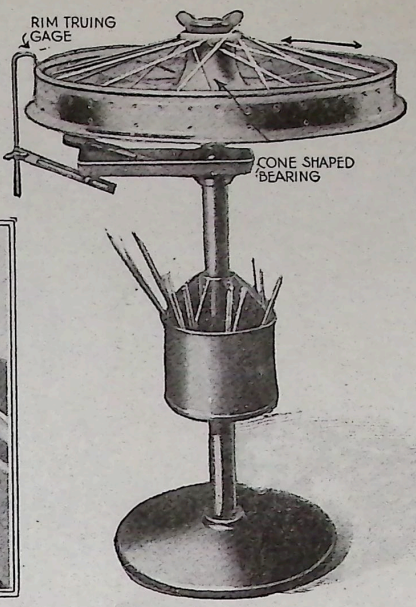
in the Automobile Garage

the more money in your purse

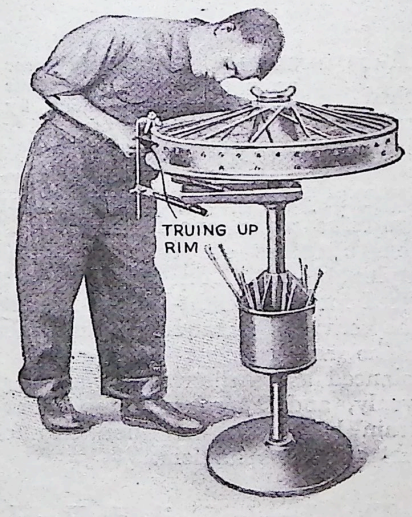


Release lock-rings with the new tool by lowering the pivoted arm so that the roller pushes down the exposed portion of the adapter-ring, freeing it from the lock-ring

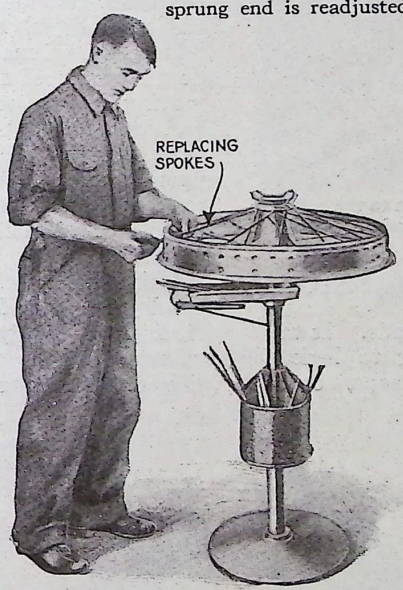
If a split ring has been sprung, it is hard to force the latching mechanism into position. Place one of the jaws against the latch and the sprung end is readjusted



Truing up and repairing wire wheels is another task that is often most difficult. But with this special stand the work is made easy. Spare spokes and other tools necessary for this kind of work are held in a cabinet below the stand, within easy reach of the workman. Some additional jobs that can be simplified by the use of this stand are shown below at the left

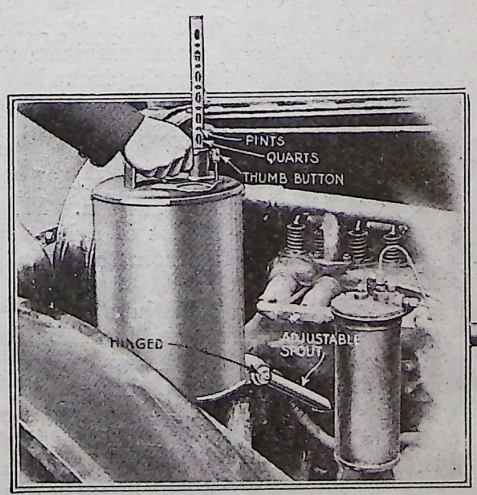


The wheel to be repaired is held at a convenient height and supported by a cone-bearing contact with the machined surface of the interior of the hub

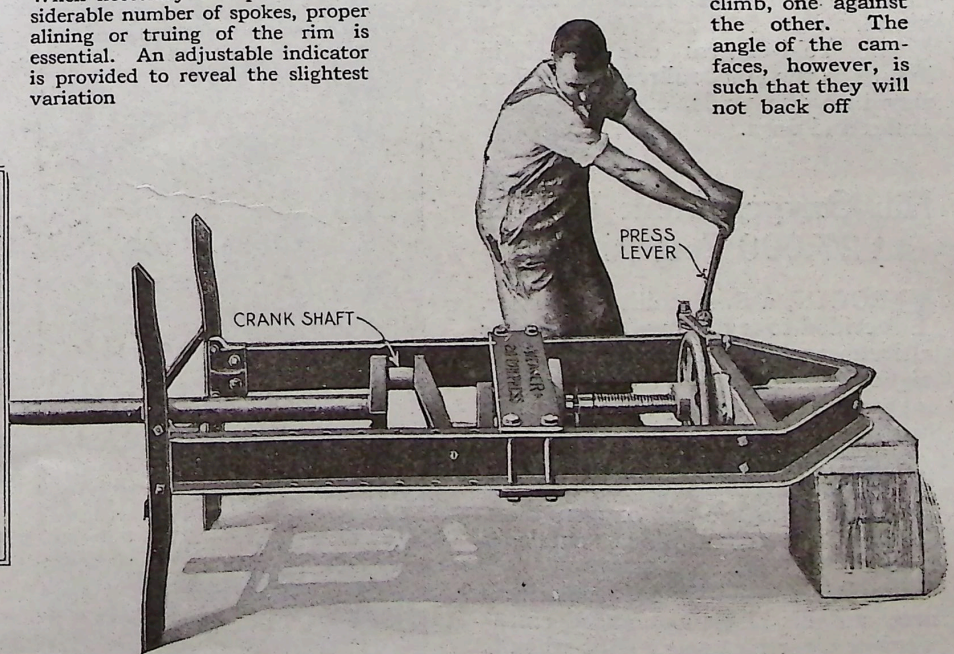


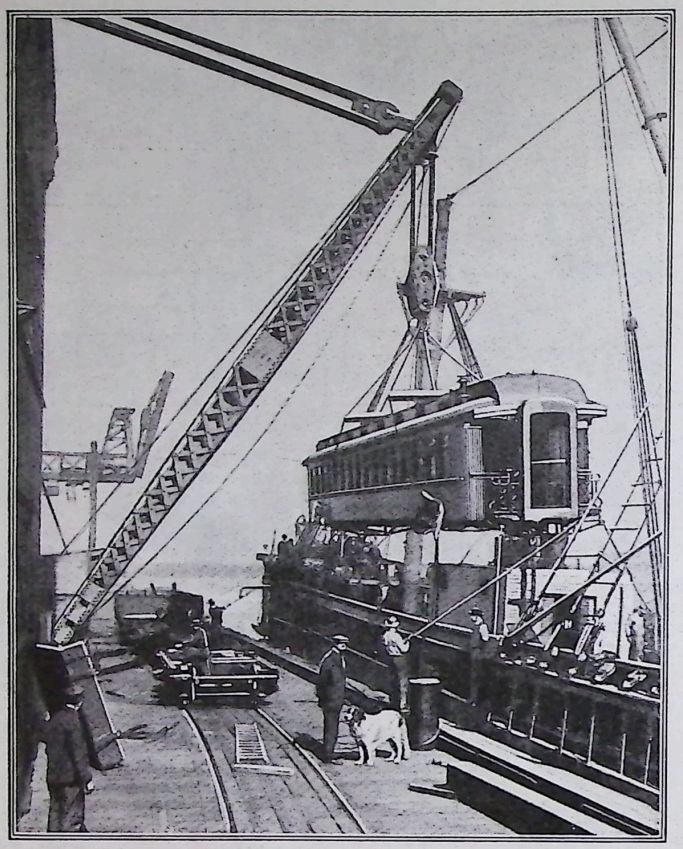
When necessary to replace a considerable number of spokes, proper alining or truing of the rim is essential. An adjustable indicator is provided to reveal the slightest variation

Here the press is shown alining a crankshaft. The pressure is secured by the use of two large cam-faced washers or thrust-bearings. As the pressure on the screw is developed by revolving the wheel to the right, these washers tend to climb, one against the other. The angle of the cam-faces, however, is such that they will not back off



Instead of the grimy funnel and the open quart measure, one may use a mechanical gravity flow. A thumb button controlls the oil discharged





How the United States is carrying a railroad system to the north. Swinging a passenger-coach aboard a steamer bound for Alaska

Carrying a Railroad to Alaska

ALASKA has been greatly in need of railroads. It was unable to build its own roads, owing to lack of facilities in the shape of steel-mills, car-shops, etc.

But now the railroad system of Alaska is being gradually built up. The rolling stock and other materials are manufactured in the United States and sent north by water. Each vessel is capable of carrying four coaches on its deck, and before many months our northernmost state will have a railroad system of which it can be proud.

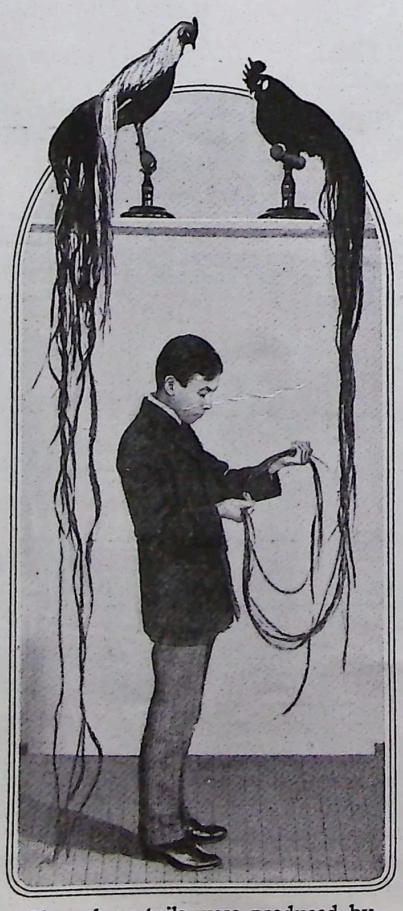
The gold-diggers can travel in luxury as the great railroads nose their way into the wilds, displacing pack-mules and dogs.

His Oxygen Tank Useless at 27,000 Feet Altitude

PROGIN, a Swiss military aviator, decided to try to break the world's altitude record. He rose higher and higher, until finally his airplane was no longer visible to the people watching him from below.

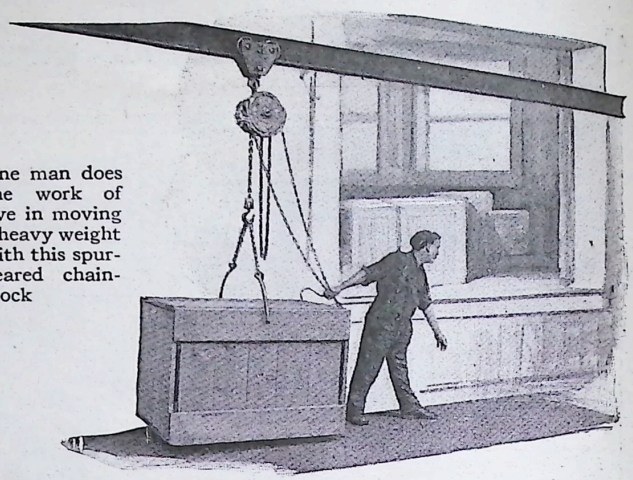
When he had reached a height of twenty-seven thousand feet, and had been forced to use his oxygen tank, one of the connections suddenly broke.

Progin immediately lost consciousness, and his airplane plunged earthward at a terrific speed. But when it reached four thousand feet, the aviator came to life, and regained control of his machine just in time to make a landing!



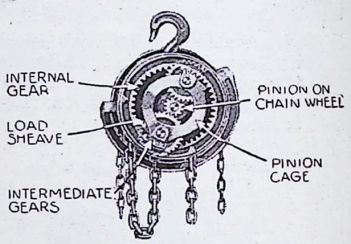
These long tails were produced by careful inbreeding of fowls whose tails molted but slightly

How One Man Lifts a Ton



One man does the work of five in moving a heavy weight with this spur-geared chain-block

ONE man with a pull of only eighty pounds can lift this one-ton block two feet from the ground in half a minute. One man can do the work of five in moving heavy weights, and he need not be a "strong man." He pulls upon a chain attached to a new "spur-geared" chain-block, and lifts the weight.



Showing the planetary-gear arrangement of the Yale spur-geared chain-block by which the lifting of weights is easily accomplished

Thirty-one feet of chain pass through the workman's hand when he pulls to raise a ton one foot high. The chain works a system of gears on the well known planetary-gear principle; blocks of one-ton or ten-ton size, or more, are used for the weight-lifting required. The heavier sizes require several men.

The arrangement of gears is so balanced as to distribute the weight evenly, and it prevents too great a strain being thrown upon any one part of the mechanism.

The Long-Tailed Fowl of Japan

IN the Uyeno Park Museum, in Tokio, Japan, there are three fowls with tail-feathers from thirteen to fifteen feet long. Only the cocks have feathers of such startling length. The hens are rather commonplace in appearance.

The long-tailed fowls settled in Japan before the Christian era. They are probably an offshoot of a Korean variety which sprang from the jungle-fowl of southern Asia.

Why do the tail-feathers grow to such lengths? Every chicken molts once a year. Chicken-growers say that sometimes a part of the chicken skips this molting season. By a process of painstaking selection and breeding, those fowls in which tail-molting season is suppressed will ultimately give rise to a strain with long tail-feathers.

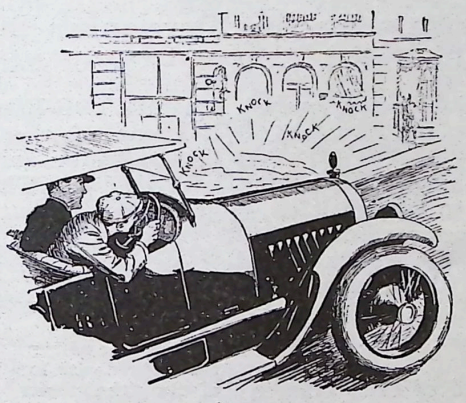
These Japanese cocks are fed, almost stuffed, in a way that would astonish American barnyard chickens. They are not allowed to move about freely; if they did so, the precious tail-feathers would break.

Learn to Interpret the Engine's Knock

By Floyd L. Darrow

WHAT makes your motor "knock"? If you know, you are unique among men. There is more misinformation current among the owners of automobiles regarding the causes of this very common ailment than of all other motor ills combined.

The carbon knock, recognized by a regular succession of distinct, almost metallic, sounds, as of blows on an anvil, is by far the most important knock that afflicts the gasoline motor. Now, every motorist knows that sooner or later a hard, graphitic layer of carbon accumulates upon the piston heads, the upper portions of the cylinders and about the valves of his engine—an accumulation due to a too liberal use of oil and a too incomplete combustion of gas. But why should this layer of carbon cause your engine to knock? Ask the average driver and you will get all sorts of curious answers. The most common error is to suppose that this carbon becomes so thick that the piston on the upstroke actually strikes the cylinder head.



Beware! When your engine knocks, it means trouble. Learn its cause, then remedy it

When you consider, however, that the series of explosions going on continuously in each cylinder brings the carbon covering the interior of the combustion chamber to a constant red heat, you have the key to the explanation.

As the piston compresses the fresh mixture of gas and air, the hot carbon, acting like a spark from the ignition system, fires the charge before the point of maximum compression is reached. Only the momentum of the flywheel carries the piston over and prevents it from being driven back downward. The shock resulting from this premature explosion is heard as a distinct knock and it will be at once seen that the decided loss of power is due to the momentary tendency to drive the piston backward.

As is well known, this knock is always noticeable when the car is on a hill or the engine is pulling hard on a slippery road. This is because at those times a richer mixture is being fed into the cylinders and the momentum of the flywheel is less. Such a mixture is more easily fired and the diminished momentum makes it less easy to carry the piston by the dead point.

On a level, smooth road, where the engine is not working hard, the explosions from the hot carbon and from the spark tend to come together at the proper point in the cycle and there is no knock.

This also explains why your motor does not knock when it is cold. On first starting a car in the morning the knock is absent, even on a hill, and you wonder where it has gone. It is at once apparent, however, that until the engine has had time to heat up, the layer of carbon is not hot enough to ignite the mixture.

Among the numerous remedies for this knock, there is only one that is really effective, and that consists in removing the cylinder head and scraping the carbon out. After scraping, the parts that have been carboned should be rubbed with fine emery-cloth and if necessary the valves must be reground. So-called carbon removers and burning out the carbon will give temporary relief only, and when an engine is badly carboned they will not do that.

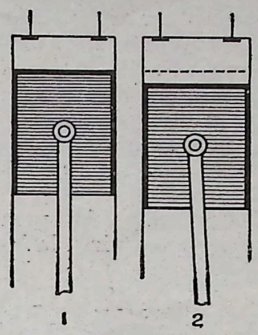
A clean engine runs like a charm, climbs hills without difficulty, and gives a maximum of power.

Another very common motor knock comes from a too-advanced spark. The proper time for the spark to appear is at the point of maximum compression, or, if the engine is running rapidly, very slightly before this point.

But if the motor is pulling hard on a hill or slippery road, and consequently running slowly as well as drawing a rich mixture of gas, an advanced spark will ignite the mixture too soon and a knock will result just as in the case of hot carbon. When the engine is running fast, the increased momentum of the flywheel carries the piston over and an advanced spark liberates the energy more nearly at the right point for maximum power. It actually takes an appreciable time for the combustion of the gas and the liberation of the pent-up energy to take place. Therefore, at such times, an advanced spark is necessary if all the energy is to be fully utilized on the downstroke.

When running slow, however, an advanced spark liberates this energy considerably before the piston has come to the top of its stroke and tends to drive it backward. The remedy for such a knock is to retard the spark.

In the case of either knock, the sound itself is produced by the play between the piston-rod and the wrist-pin. The pre-ignition, as already explained, tends to drive the piston downward, and this play permits a momentary pounding and the resulting knock. It is much more noticeable



Explosion should occur when piston is in position 1, or at end of stroke. Because of hot carbon it occurs at position 2

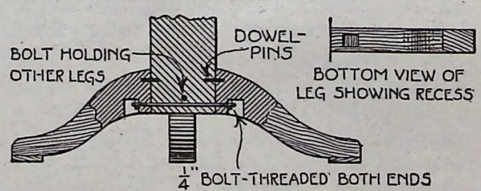
in the case of hot carbon, because the very large ignition surface produces a much more nearly instantaneous combustion than does an advanced spark.

A Neat Repair on an Old Table

TWO valuable old stand-tables, heirlooms, with very heavy marble tops, were brought to me to be repaired. The work was to be done without showing any marks of repair.

The heavy tops had caused the legs to give way, allowing the solid walnut center to touch the floor. Some one had tried to repair them with glue, but it had not held.

I took the legs off, cleaned everything thoroughly, cut a recess in each leg 2 and 3½ in. deep, 1 in. wide, and 1 in. long. Then I put one leg on, clamped it, and drilled a ⅝-in. hole through the table center and through one leg into the recess already bored.



How repairs were made to strengthen two old tables with the repair unseen

The bolt-hole for the two other legs was drilled about ½ in. above the first one so as not to enter it. A small quantity of glue was also used in addition to the bolts. This, by the way, is always advisable where parts are bolted together, unless the bolting is of a temporary nature and intended for making future adjustments possible.

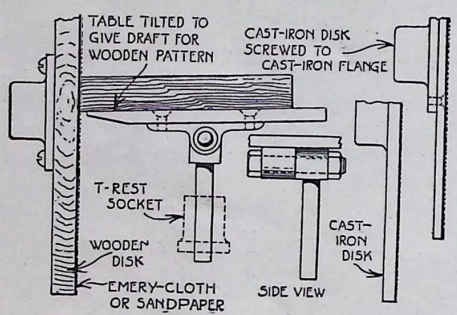
After the two tables were completed, they were exceptionally firm and not a mark showed anywhere. The repair could not be seen unless the tables were turned upside down. This was ten years ago and so far as I know the tables are in good shape today.

Disk-Grinding on the Lathe

By H. H. Parker

WHETHER equipped with an abrasive cloth disk for surfacing small metal parts or with a sandpaper disk for finishing wood patterns, mitered frames, and other articles, the small disk-grinder is an extremely useful piece of apparatus in the hands of the small-shop or home-shop man. While an ordinary grinding-stand may be easily altered to a disk-grinder, this article will deal only with its application to the small lathe.

A speed lathe is best adapted to such work, though a screw-cutting lathe



A sheet of abrasive glued to a wooden wheel, if placed on a lathe, makes an excellent grinder

with a fairly high-speed step may be used by making the disk of relatively large diameter. A grinding-disk mounted on the live spindle and driven at a good speed, in combination with an adjustable table held in the T-rest socket, will finish the surfaces of small metal parts practically as well as would a shaper or miller, and if much pattern work is done, a sandpaper disk will become indispensable.

The simplest form of grinding-disk is made by screwing a square block of hardwood to a small faceplate, sawing off the corners, then mounting it in the lathe and turning to circular form and facing off smoothly to a plane surface.

The abrasive disk is cut from a sheet of the material and glued to the wooden face of the turned block, and the grinder is complete. This type has the advantage of offering a good surface to glue the sandpaper or emery sheet to, but if out of use for a long time is likely to warp or perhaps check, in which condition there would be a certain amount of danger connected with its use at high speed.

A Grinder from Boiler Plate

A more substantial grinding-disk may be made by turning up a piece of boiler plate or sheet steel to circular form and attaching it to a small cast-iron faceplate by means of countersunk machine screws, the faceplate screwing on to the lathe spindle-nose. Another way would be to make the whole contrivance of cast iron, boring and threading the hub to fit on the spindle nose and then turning off smoothly all over.

Guarding Against Blow-Holes

In using cast iron the casting should be carefully examined after the machining for cracks or blow-holes which might weaken it. If trouble is experienced in having the abrasive disk peel off after gluing on, this may be overcome by first gluing a sheet of very thin tissue-paper to the iron faceplate, allowing the glue to dry and then gluing the abrasive disk over the tissue-paper.

A tilting table should be constructed with a shank of the proper size to fit into the lathe T-rest socket. The table may either be cast from patterns or built up of a rectangular iron plate beneath which a cast-iron dolly-box is screwed. Then the shank is turned up from a length of square cold-rolled steel and about 1¼ in. at one end left square, this end being drilled for the clamp bolt which clamps the shank to the dolly-box or cast lug on the table.

By setting the table at the proper angle it is an easy matter to grind a uniform amount of "draft" upon the edges of wood patterns.

After a certain amount of usage, the abrasive disk becomes clogged up and worn down and must be removed and replaced with a fresh one.

The Government's Recipe for Whitewash

HERE is the United States Government's standard recipe for whitewash.

Slack one half bushel of unslacked lime in boiling water, keeping it covered during the process. Strain, and add a peck of salt dissolved in warm water. Add also three pounds of ground rice boiled to a thin paste and one pound of Spanish whiting.

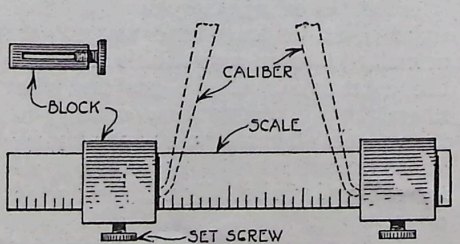
Dissolve a pound of clear glue in water and add. Mix the whole thoroughly and after stirring it vigorously allow it to stand and settle for at least a day or two before using the whitewash.

Heat the mixture thoroughly before applying it.

Here's an Easy Way to Set Inside Calipers

TO set an inside caliper to size is not as easy as one would imagine, especially by the regular method. Here is the way I overcame the trouble.

I made two blocks, as shown in the illustration, to fit my scale. Through

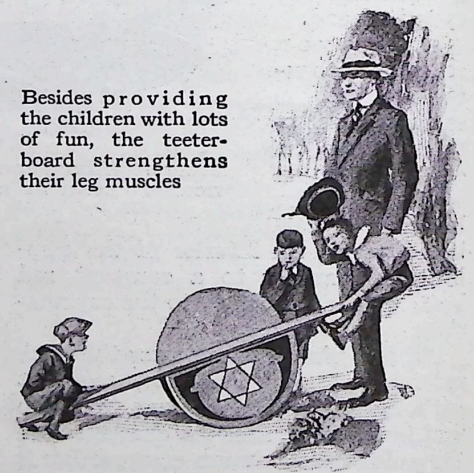


If two blocks are placed upon the scale, it is easy to set a pair of inside calipers

each block I placed a binding-screw. Then I set the blocks where I wanted them on the scale, set my calipers to the distance in between, and the job was done.—J. W. Moore.

Developing the Leg Muscles of Children

A TEETER-BOARD is probably one of the oldest amusement devices known and is always popular with children. The rocker teeter is a great improvement over the old device,



Besides providing the children with lots of fun, the teeter-board strengthens their leg muscles

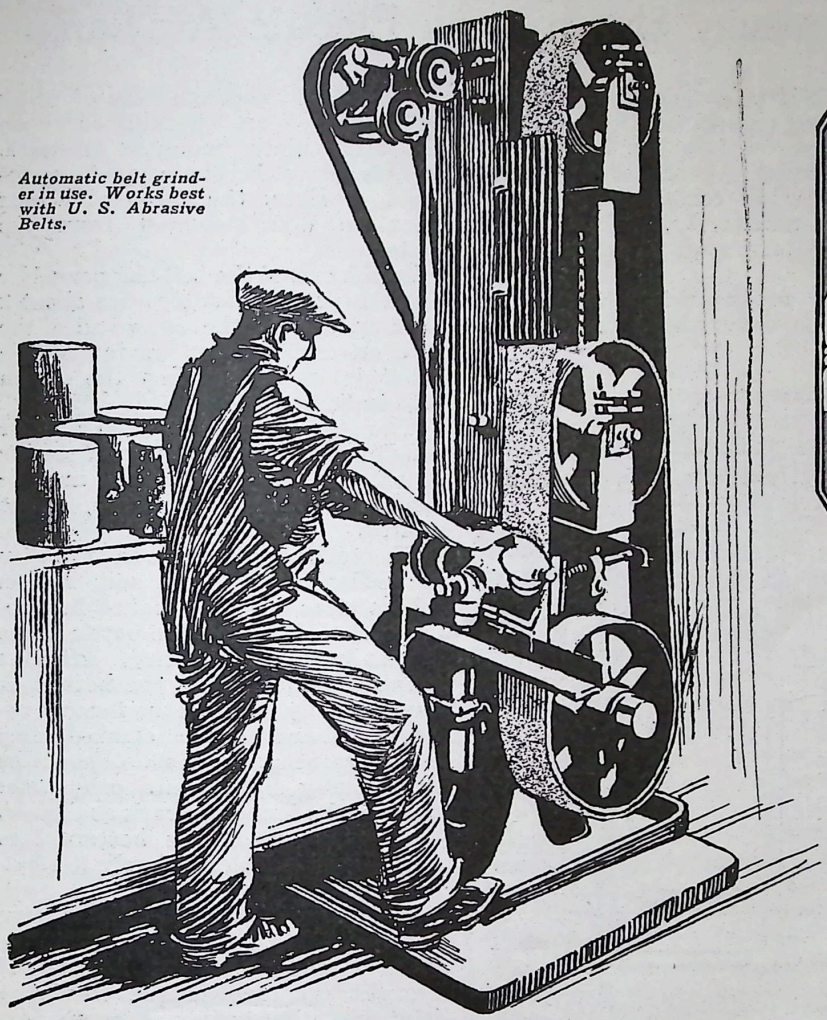
as it is smoother in action and prevents the jar as the child's feet touch the ground.

It may be constructed by using a board 10 ft. long, 1 ft. wide, and 1 in. thick.

The rockers are usually made from 1-in. board cut in a semicircle, the flat side measuring 2 ft. long and 1 ft. across the center of rockers, there being two in number.

Strips of wood, three in number, are placed between the rockers to prevent them from spreading.

The teeter-board is nailed to these rockers after being balanced. Notches may be cut near the ends of this board large enough to permit the child's legs to fit in, and the board is ready for service, and it will be found a constant delight.—Charles C. Wagner.



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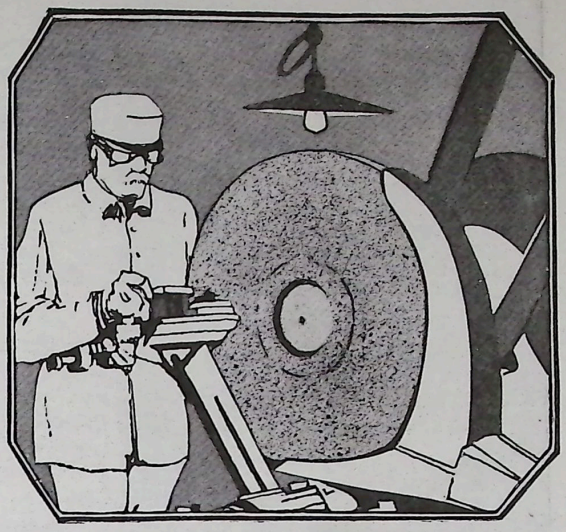

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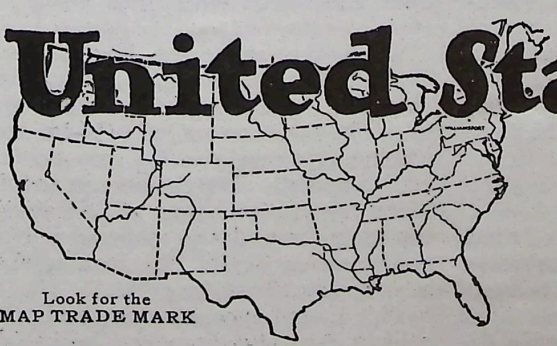
Tough, especially-made paper, strong cloth, and glue that everlastingly holds the tiny particles of abrasives, are combined, seasoned and inspected before the finished product is worthy of the U. S. Map trademark.



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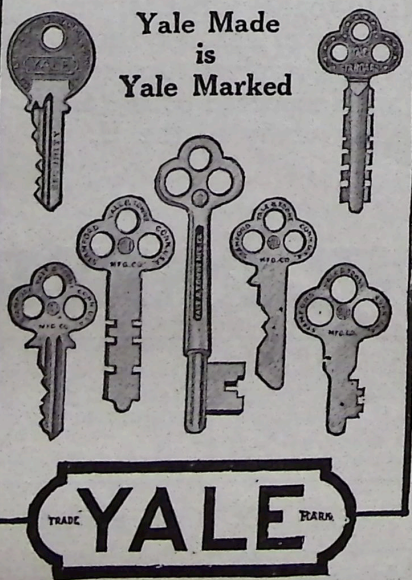
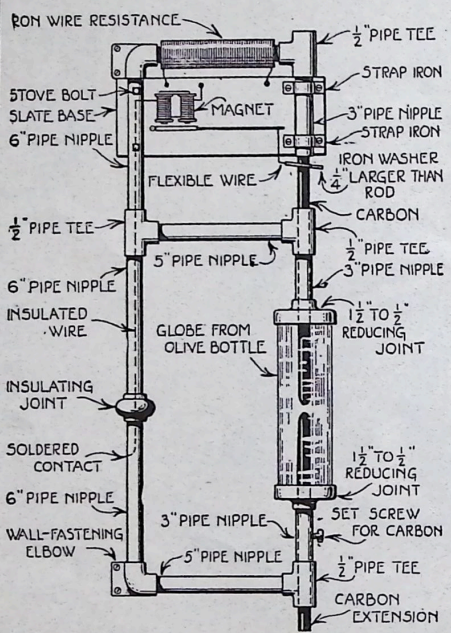


Ingenuity Shown in an Electric Arc-Lamp

By Theron P. Foote

WITH a few odds and ends of gas-pipe, an old iron box bell, and a mica insulating-joint such as electricians use on combination gas and electric fixtures, I have constructed a very serviceable homemade arc-lamp.

The accompanying illustration shows in detail the ½-in. gas-pipe connections and gives approximate dimensions. The two ½-in. elbow-joints are those having flanges with screw-holes so that the apparatus may be fastened upon the wall. Four ½-in. T's, 3 6-in. nipples, all of ½-in. pipe and having right-hand threads on both ends, constitute the required fittings.



The construction and assembly of a home-made arc-lamp made from odds and ends about the house

The magnets and armature of the bell are removed and reconnected, bringing the leads of the magnet directly out instead of in series with the armature contact screw, thus making the bell mechanism a single-stroke instead of vibrating. A heavy piece of galvanized iron—sheet iron, or slate, approximately 3 by 7 in., is fastened by machine screws, stove-bolts or pipe-clamps to the top of the pipe structure, and the magnets and armature mounted upon the plate in alinement with the pipe-fittings. On the back side of the plate may be mounted a single-throw double-pole switch for controlling the circuit.

Around the top 5-in. nipple, wind with 2 or 3 turns a piece of asbestos paper, using plenty of shellac to keep it wound tight and in place.

About 36 turns of No. 16 or No. 18 iron resistance wire should be wound upon this asbestos, forming a resistance coil, the ends of which are terminated upon the slate plate mounted beneath. If this plate is made of iron instead of slate, the terminal screws must be well insulated from the plate.

To the end of the bell-clapper solder a small piece of flexible wire about 2 in. long, and on the other end of the wire an iron washer having a hole about ¼ in. larger than the carbon rods to be used.

Two ½ in. by 1½ in. or larger couplings are placed in two of the T's so that a large glass tube may be supported around the arc, if so desired.

This tube may be made from an olive bottle by cutting top and bottom with a piece of string soaked in gasoline and tied around the bottle in the correct location for cutting. After the string is ignited from the bottom, it burns rapidly. When the flame is extinguished and while the charred string is still glowing, the bottle should be immediately dipped into cold water and will be found to crack as desired.

A set screw in the bottom 3-in. nipple aids in holding firmly the bottom carbon.

A piece of asbestos-covered wire about size No. 10 is soldered into the inside of the lowest 6-in. nipple and brought up through the insulating joint and other couplings, coming out through the nipple near the magnets and connects with one side of the double-pole switch.

The magnet wires connect with the same binding-posts as the resistance-coil leads, and one binding-post connects with the upper carbon by means of a clamp on the carbon rod and a flexible connection. The other binding-post is connected with the remaining side of the double-pole switch. The positive side of the incoming circuit should also be connected with that side of the switch.

As the current passes through the magnets, the armature pulls on the washer, causing it to grip the carbon and lift it up, thus forming the arc. As the carbon gradually burns away, less current passes through the magnets, causing the carbon to sink lower and keeping it at the right distance from the lower carbon to form an arc.

When the armature has become lowered as far as it will go, the washer on the carbon should be low enough to strike on top of the ½-in. tee, causing it to release its grip on the carbon and allowing the carbon to fall. More current will now pass through the magnets and the carbons will be pulled apart again, the iron washer having taken another grip.

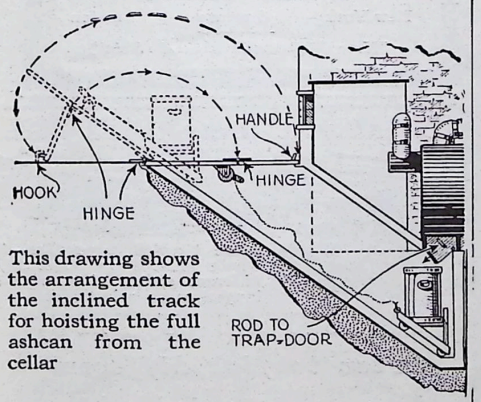
This action is continuous, and with a little care the lamp can be so adjusted that there will be no flickering of the light.

Make It Easier to Remove the Ashes

A DEVICE for the removal of furnace ashes is shown in the two illustrations. A car with an ashcan is drawn up an enclosed incline from beneath the furnace to a point outside the building. A trapdoor in the floor of the ashpit and over the can is opened by means of a rod at the side of the furnace.

No more carrying heavy cans up and down the cellar stairs. This dustless elevator does it for you

The ashes are pushed into the hole with a furnace hoe. The trapdoor is normally closed so as not to affect the draft of the fire.

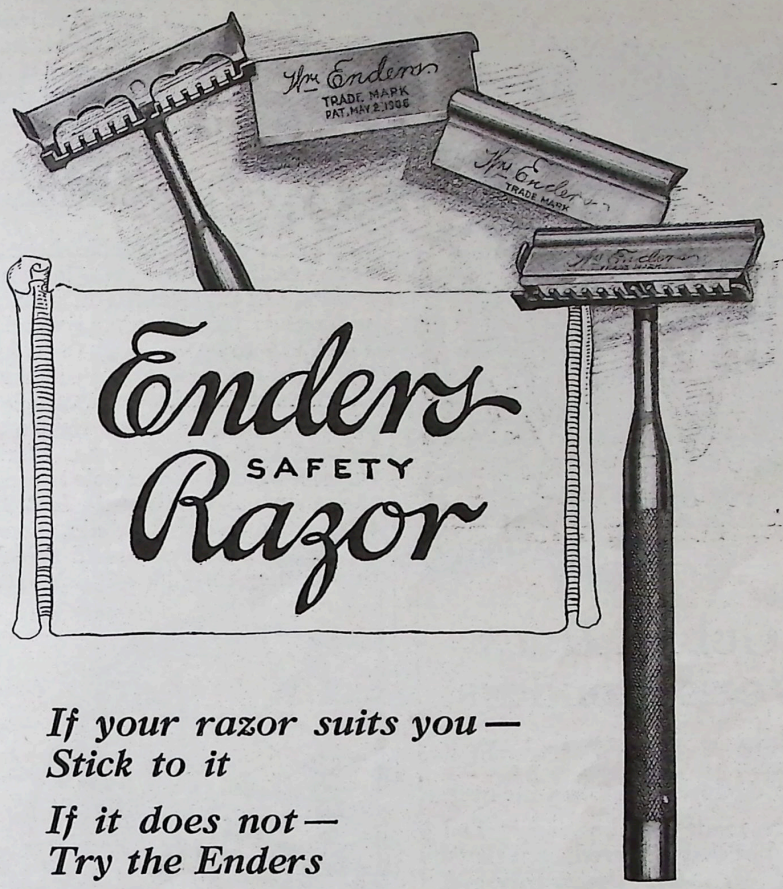


This drawing shows the arrangement of the inclined track for hoisting the full ashcan from the cellar

When the can is filled with ashes, a door made in two sections is opened at the top of the incline. The car is drawn up by means of a winch fixed to one of the sections and the filled can exchanged for an empty one. Thus the ashes cannot even sift into the cellar.

Protecting Sliding Wagon Wheels from Wear

BEFORE descending a steep hill, it is a common practice to lock a rear wheel of a heavily loaded wagon which is not provided with the usual service brakes. This protects the wagon and its load, and also prevents the wagon running over the animals. The usual method of locking is to have a small chain attached by one end to the side of the wagon-box and to tie the other end to a wheel-spoke or to the rim itself. This method is dangerous to the wheel, because if it were to



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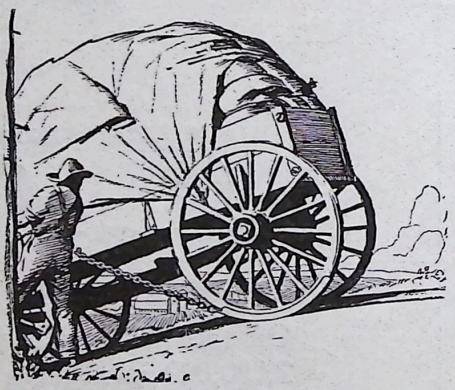
strike an obstruction or drop suddenly into a hole in the road, it would naturally deliver a swift, powerful jerk to the wheel and possibly break out a spoke or fracture the rim. It also causes considerable wear to the tire by dragging it abruptly on the ground down the entire grade.

A simple homemade locking device called a "slide lock" eliminates all these troubles.

Take a piece of malleable sheet-iron of any desired thickness (¼ in. is preferable), and cut from it a strip an inch wider than the tire of the wheel on which it is to be used and 18 in. long. Curve the piece sidewise to conform to the circle of the wheel, and turn ½ in. of each edge upward at a right angle, leaving 2 in. of one end straight through which to drill a hole to receive the chain. After the hole is drilled, cut the end link of the chain, insert in the drilled hole, and reweld together, thus uniting the slide with the chain.



Illustrating how the wagon slide looks when in position on a hill. It also protects the wheel from wear

Attach the chain as formerly by one end to the side of the wagon-box and provide a hook also in the side of the box for hanging up the chain and slide when not in service. When ready to lock the wheel, stop the team, and lay the slide immediately ahead of the wheel, where it will make sure to roll on it between the turned-up edges and drive ahead. The chain must be of proper length so that when the slide is directly under the wheel it will be fully stretched. The wheel will thus slide down on this slide lock, free from all danger of breakage and wear to the tire. The turned-up edges of the slide will prevent it from slipping out from under the wheel. There is absolutely no strain on the wheel when locked.—L. M. JORDAN.

Heating the Automobile's Front Seat

MOST flow-heaters for automobiles seem to be designed for the rear compartment and not for the front seat. The heater shown in the illustration is designed for runabouts, roadsters, and particularly the type of automobile that affords no protection for the driver against cold, such as taxicabs, town cars and limousines.

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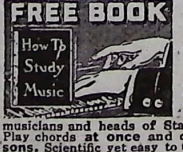

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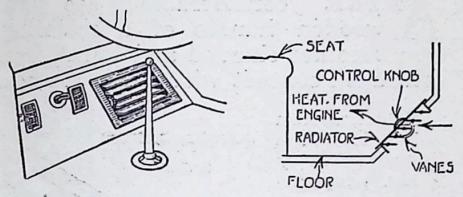
The radiator is simply an ordinary floor radiator such as is used in hot-air systems of house-heating. The adjustable vane type with the ribbed foot-control knob is of course the most desirable, as it will allow the driver to permit as little or as much heat as he desires to come through.

The size of the radiator used depends on the amount of clear floor space. As the illustration indicates, a hole is cut through the slanting part of



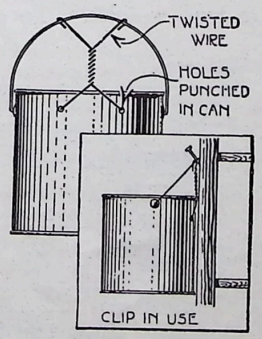
If you equip the driving compartment of your automobile with a heater now, there won't be any cold feet this winter

the floor and the radiator set in and screwed down. It will be found that a surprising amount of heat comes through when the radiator is wide open. A heater of this sort assures much more comfortable driving in an open car when the winter weather is severe.—FRANK W. HARTH.

Holding Paint-Pail Bail to One Side

THE good old-fashioned way to paint small buildings is to get the ladder and hang thereon the pail of paint while the brush is shifted from one hand to the other, as the arms tire. But the nail sometimes bends under its load of lead, and spills its two or three dollars' worth of contents upon the ground.

Not having a pail-hook handy, and having the above-mentioned accident happen, a man made a simple clip from two wires, with which the bail of the pail was kept at one side, thus affording plenty of room for dipping the brush, and at the same time holding the pail secure upon its nail in the side of the ladder.



If the pail is held as shown in the illustration, there will be no danger of its contents spilling

The clip consists of two lengths of wire, each 6 or 7 in. long, and twisted in the center, leaving 1½ in. at the lower end and 2 in. at the upper. The ends are bent into hooks, the lower ones hooking into two holes punched in the rim of the pail and the upper ones over the bail.

The size of the clip will be determined by the size of the pail being used.

"I'm sorry I stepped on your train, but here's some nice new string to pull it with."

AFTER a period of starvation a man needs time to build up his system again. And so our railroads need time before the tonic effects of the recent rate increase can be shown in improved service.

During the period of government control increased wages and costs for material left little over from a stationary income to buy much-needed equipment—or even to keep the existing cars and engines in order.

To rebuild this equipment the railroads must secure hundreds of millions of dollars of new capital: the rate increase placed no such lump sum at their disposal. It merely gave them a chance to make a fair living, to insure reasonable dividends to their investors, and thus to attract the money of new investors.

Right here is where we can help.

Every dollar we place in a railroad security will have a share in buying some freight car or locomotive to bring us the goods we want when we need them.

Every hour we save as shippers or receivers of freight in loading and unloading the cars will enable them to get into action again the more quickly.

Or as suppliers of material or equipment we can give first place to the orders of railroads, and thus help them speed up reconstruction.

So by putting a shoulder to the wheel and keeping patient, we all can hasten the glad day when the 8:05 will always be on time and we can be sure of getting that furnace for the same winter we ordered it.

Published in the interest of Electrical Development by an Institution that will be helped by whatever helps the Industry.

Western Electric Company

No. 20 *To do its share in restoring the railroad service, from the Atlantic to the Pacific, from the Gulf clear across the Canadian border the Western Electric Company is hurrying delivery of electrical supplies to the railroads.*

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$5,000 TRAFFIC JOBS

100,000 High-Salaried Men Needed!

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Now through the American Commerce Association you receive the help of many of America's greatest traffic managers in preparing for this fascinating field. Because of the tremendous need for traffic managers these famous experts of the Association's staff are eager to put you on their list to be trained for one of the big positions open. Railroads, shippers and ship owners are literally crying for traffic men. You don't have to quit your present job in order to prepare for one of these positions. Such men as T. Albert Gantt, Traffic Manager, Corn Products Refining Company; William Scott Cowie, American Freight Board Committee; Samuel G. Lutz, Vice President, Chicago & Alton R. R., and nearly 200 others of equal prominence train you quickly and thoroughly in your spare time and at a cost so trifling that any ambitious man can easily take advantage of this great opportunity.

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It is easy to understand why traffic men are in such need and why they receive such big salaries. A traffic man recently saved his concern $24,000 on shipments to their new plant in Chattanooga. Another saved $9,751 in shipping 66 carloads in two weeks. Another saved his firm $36,000 by applying a differential rate on 1,500 cars from Pittsburgh to Canada.

Traffic Experts saved an automobile concern $640,000 in ten months. A traffic expert discovered that freight rates paid by the Meeker Coal Company were legal, but exorbitant. A ruling secured from the Interstate Commission resulted in a refund of $122,000. An oil shipper in Kansas was losing over $30 every day—$700 monthly—because he did not know of certain tariff regulations entitling him to lower rates.

Is it any wonder that the traffic experts who can save their employers hundreds and thousands of dollars in freight charges are highly paid? Such knowledge can almost dictate its own salary.

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"Swap" your spare time for a big traffic job. Mail coupon now for free book. Explains why firms all over the country are needing trained traffic men to handle their shipping and traffic problems economically and efficiently. Gives full information about opportunities open to you and how you can earn $5,000 a year and more in this interesting profession. This free book will open your eyes to a new, uncrowded profession just as eager for your trained services as to pay you big money for them. Mail Coupon today.

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Please send me without obligation, your new book, "A New Profession," and tell me how I can qualify for Traffic Management.

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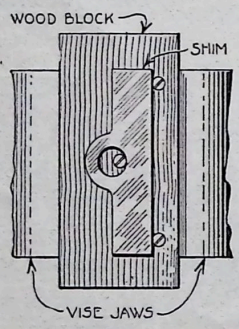
Address.....

How to Properly Fit Bearing-Shims

THE removal of bearing-shims to compensate for wear in connecting-rods of an engine that has not seen much service is not difficult, even with those of limited experience in this line. With an old engine this is not so simple. The connecting-rod bearings are provided with a thick metal shim and some smaller ones, and in the old engine it is advisable to file down this thick shim slightly after the bearings have worn down farther than is provided for by the removal of these thinner shims.

If new shims that are slightly thinner than the old ones can be had, it is advisable to make use of them, as it requires some skill to file them to a perfect flat surface. Should the shims be filed, a jig similar to that in the illustration should be made from a block of wood and three screws. Continue to turn the screws into the wood until the screws are just underneath the shims.



A block of wood beneath the shim will permit it to be filed to a uniform thickness

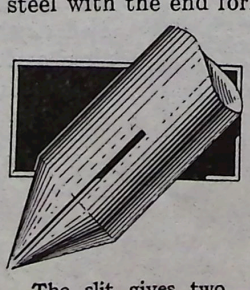
It is essential that the thickness of the shim after filing is as nearly uniform as possible, and the surface even at all points. If the wood is long enough (approximately 7 in.), it is quite easy to maintain a flat filing position by keeping the file always parallel to the wood surface.

A very little filing will usually bring the bearing surface far enough down to remove a knock, and for this reason it is advisable to try and fit the bearing after every few strokes of the file, to guard against the shim becoming too thin.—RONALD L. PRINDLE.

Here Is Shown a Novel Centering-Drill

A CENTERING-DRILL that makes a beautifully smooth seat for the lathe center is made from a piece of steel with the end formed exactly like a lathe center.

A slit is cut, as in the drawing. The length of the slit is about twice the length of the tapered portion of the tool. The tool should be hardened and tempered like an ordinary drill.



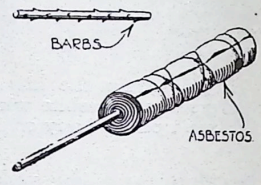
The slit gives two cutting edges to this centering-tool

When fed into a small hole drilled for the center position, the slit allows the two halves to spring out far enough to make a cut. If too much pressure is used in feeding, the edges will be forced into line again and will not cut. The proper pressure is easily gaged, however. The tool is sharpened by grinding in the same way that the lathe center is ground.

A Non-Burning Handle for a Soldering-Iron

AFTER considerable use the wooden handle of a soldering-iron becomes charred and burnt from continued contact with heat. A non-burning handle can be made in the following way:

Soldering-iron handles soon burn off. Why not wrap asbestos paper around the shank and have a non-burning handle?



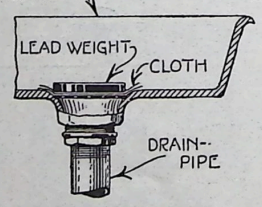
Remove the ferrule and handle and raise several sharp barbs along the end of the shank with a cold chisel.

Then cut a strip of asbestos paper about 5 in. wide and wrap about the barbed shank until a suitably thick handle is acquired. Bind it tight with several turns of fine wire and you have a handle that will outlast half a dozen wooden ones.

Filling the Kitchen Sink with Water

OFTENTIMES the dishpan is too small, so we decide to fill the kitchen sink with water. This we cannot do because there is no way to stop the outlet.

A convenient way to do this is to use a lead weight. To make this weight,



Some cloth and a lead weight over the sink drain enable you to fill the sink with water

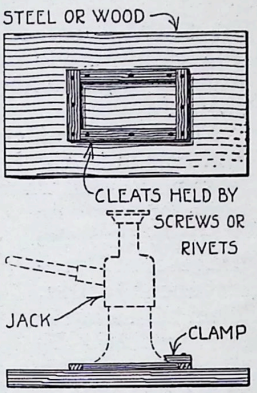
select a can lid slightly smaller in diameter than the metallic colander outlet of the sink. A one-pound coffee-can lid is usually the right size. Melt scraps of lead on the stove and pour the molten metal into the can lid and lay aside until it is cold. Make sure that the lead does not slop over on your hands and burn you.

Fold four to eight thicknesses of cloth and lay them flat on the sink drain; then put the lead weight on the cloth and fill the sink. The suction of the water and the weight make a container of the sink and you can fill it with water. In place of the cloth, one or more pieces of rubber, taken from a discarded hot-water bottle, may be used.—J. ALEXANDER.

An Extra Base for the Automobile Jack

WHEN jacking up the car in the mud or sand, it is the usual thing for the bottom of the jack to sink gradually out of sight and subsequently lower the wheel until it again touches the ground. To do away with this annoyance why not carry a supplementary base to support the jack in such soft foundation? One suggested

When changing a tire on the road it sometimes happens that the jack sinks deeply in the sand. Why not use a wooden base and make the change in comfort?

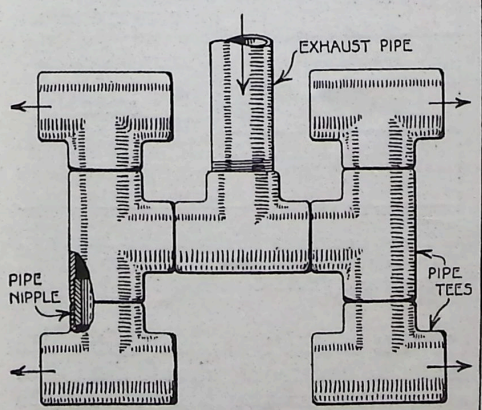


is shown in the illustration. It can be made of heavy thick wood or of a large piece of sheet steel. Arrange four cleats in a position which will fit about the base of the jack and hold it in the center of the base, thus preventing it from skidding to one side if the base tips out of the horizontal.

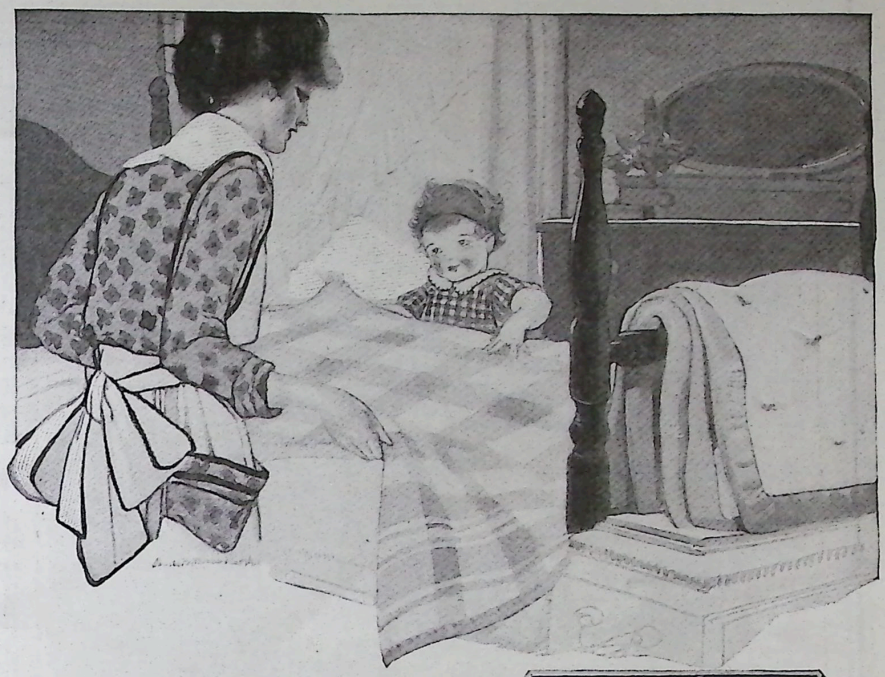
If desired, a clamp can be arranged to turn over one edge of the jack base so it will not lift out of the cleats when the handle is being operated. A base 8 in. by 10 in. should suffice to support the weight of a large car under such conditions.—T. HALLETT.

Pipe-Fittings Make a Very Good Muffler

A MUFFLER that gives good results, is easily made, and costs very little, can be put together from the commonest kind of pipe-fittings, nothing being required but seven tees and six short nipples. Screw a tee on the end of the exhaust pipe, and in each branch screw a nipple. Put on two tees, one on each end of the first,

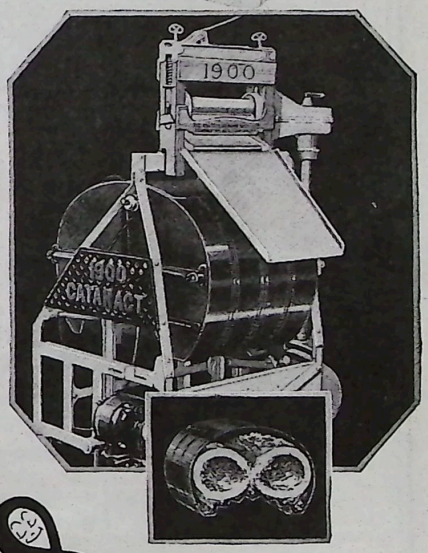


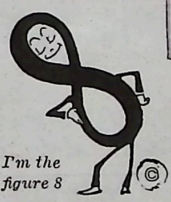
Stationary gasoline engines make a lot of noise if not provided with a muffler. Here is the way to make a good one



THE washing of heavy bed linen and blankets can be one of the easiest household duties, if they are washed in a 1900 Cataract Electric Washer with its exclusive figure 8 movement!

"But why," you say, "a 1900 Cataract, in preference to any other washing machine?" *Because of the magic figure 8 movement!*





The water swirls through the clothes in a figure 8 motion four times as often as in the ordinary washer.

By means of this exclusive feature the soapy cleansing water swirls through the clothes in a figure 8 motion, *four times* as often as in the ordinary washer. Swiftly, steadily, the water swishes back and forth, going through those clothes with *every motion* of the tub. Thus the clothes are washed rapidly and thoroughly.

And that shiny copper tub—the inside is smooth as one's hand. Not a part in it to catch the clothes or to cause wear and tear. No heavy parts to lift out and clean after the wash is finished. Then there's the smooth-running, silent wringer that also works electrically—it can be shifted from the washer clear over to the waiting clothes basket without moving the washer or requiring one extra step.

The 1900 Cataract Washer costs a few cents an hour to operate, and it washes the clothes in 8 to 10 minutes, cleaning equally well the heavy clothes, and the sheer fine undergarments or delicate blouses.

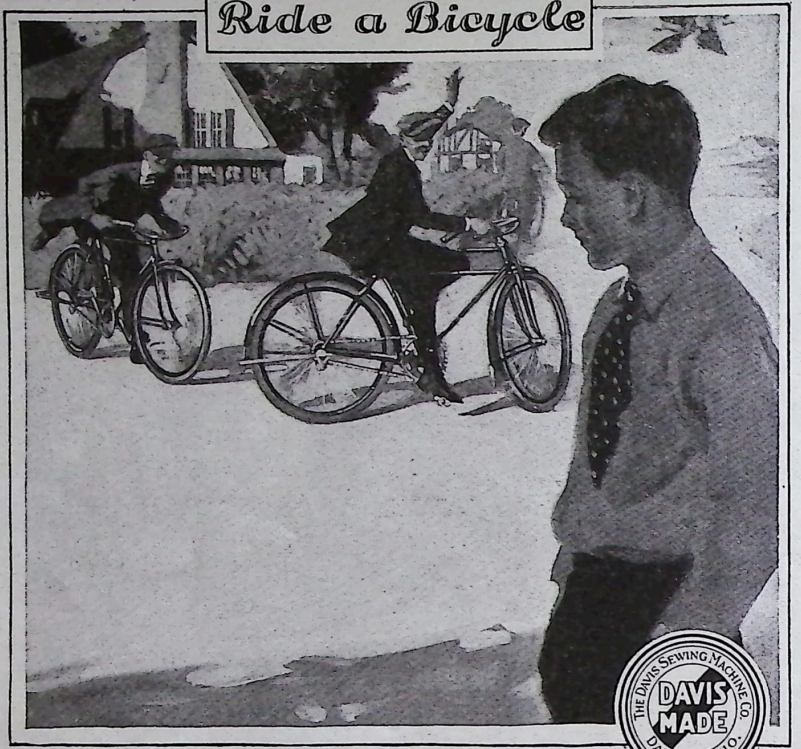
1900 CATARACT WASHER

If you want to know more about the 1900, send for the interesting book, George Brinton's Wife, a book of fiction with some surprising facts included.

1900 WASHER COMPANY, 206 Clinton St., Binghamton, N. Y.

Canadian Factory and Office, Canadian 1900 Washer Company, 357 Yonge Street, Toronto

Ride a Bicycle



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We back this Trade-Mark with our Reputation

Left all alone again—cut off from his friends—denied their healthy fun and companionship! Is this *your* fix?

Fun, health and quick, convenient, economical and dependable transportation to school or work. That's what a bicycle means. What else can you buy for so *little* that will bring you so *much*?

Write today for your dealer's name and copy of handsome new 1921 Dayton Catalog No. 44 showing 8 models for men, women, boys and girls.

Dayton Bicycles

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POPULAR SCIENCE MONTHLY
225 W. 39th Street, New York

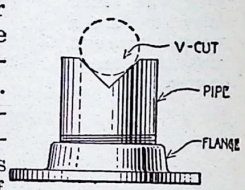
screwing them on the nipples. Then put four nipples in the four tee branches and attach four more tees.

The layout is clearly shown in the illustration. The exhaust gas is broken up into a number of streams and is greatly expanded and slowed down in escaping. It will be found that there is no back pressure.

V-Blocks Made of a Piece of Pipe

A SMALL set of V-blocks can be easily made for bench use by utilizing pipe fittings in the manner shown.

First get a sufficiently large flange and bolt it to the bench in a convenient position. Then thread a short piece of pipe or a nipple into the flange so it will project about 5 or 6 in. Then with a hacksaw cut two V-shaped openings in the top edge of the pipe exactly opposite each other. File away any unevenness and try to get the cuts the same size and shape, so a round rod, reaching across, will fit in the cuts without any chance of wabbling.

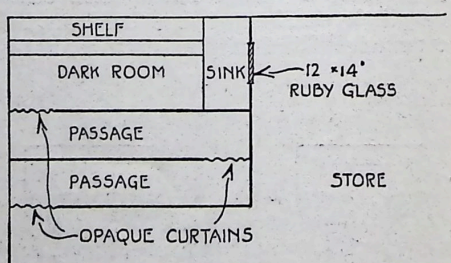


Such a set of V-blocks is ideal for handling small shafting, wrist-pins, etc.

No Light Can Get into This Darkroom

A DEALER in photographic supplies was often asked for the loan of his darkroom, and several times people had opened the door, not knowing the room was in use. Of course this spoiled the plates and films then being developed.

The photographer was exceedingly annoyed by this, so he figured a way by



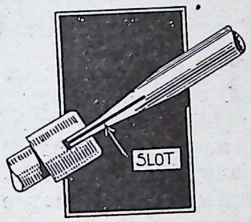
Three doorways covered with heavy curtains permitted entrance to this darkroom while developing

which it couldn't happen again. He made a darkroom about nine feet square, and, as you will note by the diagram, there were three doorways, each covered with a heavy black curtain. The curtains were equipped with lead weights at the bottom so that they would stay in place at all times. With this scheme in use one could enter and leave the darkroom without danger of spoiling the films being developed.—CORA HAMILTON.

An Expanding Screwdriver Made at Home

ANY instrument maker, adding-machine assembler, typewriter repairman, etc., will appreciate this expanding screwdriver, which is very efficient and practical.

When you have to replace a screw in an almost enclosed corner, where you cannot use your fingers, all you have to do with this improved screwdriver is to pinch the tongues together and press it into the slot of screw, which it will hold firmly and not drop, as would be the case with a magnetized screwdriver. Any mechanic or boy can make this tool out of a piece of drill rod, and to save time, you can use an old screwdriver with the aid of a hack-saw and fine narrow file.—H. E. MENDE.



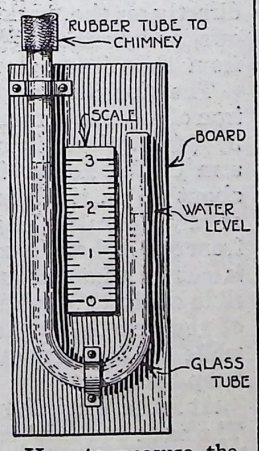
This tool was made from an old screw-driver

Save Coal with This Simple Draft-Gage

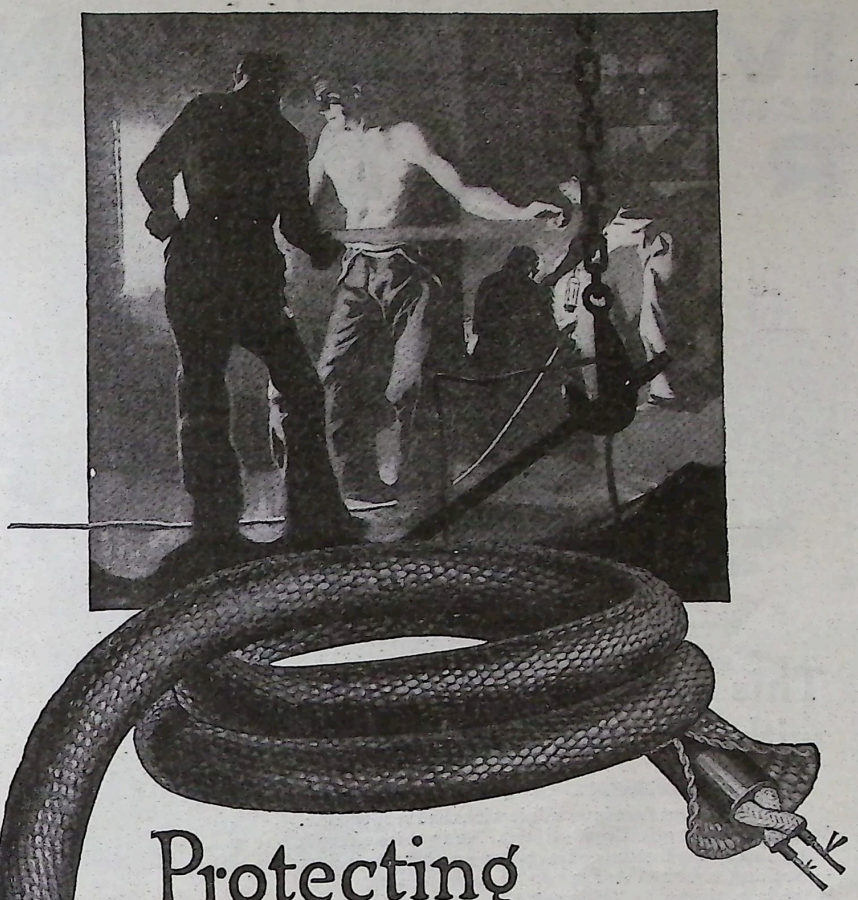
THE production of draft in a chimney and the satisfactory operation of the boiler connected with the chimney depend upon the pressure difference between the heated gases in the chimney and the outside air pressure. To operate the boiler to its maximum advantage, especially in house-heating (for which this article is intended), it is necessary that there be some visible means of knowing this pressure difference or draft.

The intensity of the draft may be measured by means of the little water-gage shown in the accompanying illustration. It is easily constructed from a piece of glass tube bent into the shape of a letter *U*. One leg passes over the top of the supporting panel and communicates with the pipe leading to the chimney or straight into the chimney itself. A short length of rubber tube is used to make the connection. The difference in the two water levels in the glass legs represents the draft, expressed in inches of water. For the convenience of reading a scale is placed between the two legs.

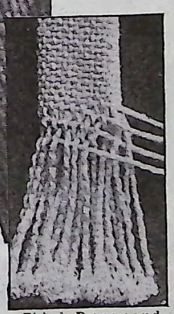
The draft produced by a chimney may vary from ½ to 2 or more inches of water, depending upon winds, gas temperatures, and the height of the chimney. A high chimney with low gas temperature is the most advan-



How to measure the draft in your chimney



Protecting the Insulation

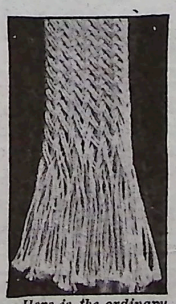


This is Duracord. Thick, heavy strands, woven like a piece of fire hose, not braided. Picture shows outside covering only with impregnating compound removed.

THE real mechanical strength of any portable electric cord is in the *outside covering*. Once this covering wears through, the insulation is an easy prey to hard knocks, abrasion, oil, moisture, heat and even light—for light tends to make rubber brittle.

Duracord has a thick, heavy fabric cover *woven* like a piece of fire hose instead of the usual light braid. That's why it outwears ordinary cords 4 to 6 times. It has unusual strength where the wear comes—on the outside.

Duracord can be furnished in all sizes of portable electric cord and also in the larger sizes of single and duplex cable. Ask your electrical jobber about Duracord or let us send you samples of Duracord and ordinary cord for you to test and compare yourself.



Here is the ordinary braided cable covering. Note the open and porous construction, easily cut, stretched or unraveled. Compare it with the illustration of Duracord above.

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Flexible Non-Metallic Conduit
and tubular woven fabrics of all kinds

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SAFETY AUTOMATIC
REVOLVER

★ *Reproduction of an actual newspaper clipping, but with names omitted.*

This could not happen with an IVER JOHNSON

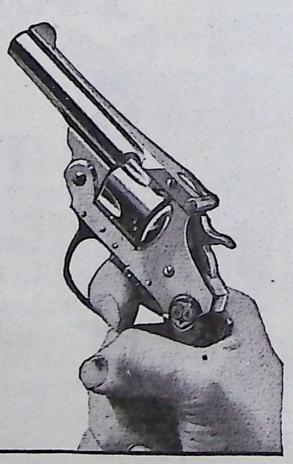
A jolt—an accidental discharge—and a fatal injury.

Such accidents are impossible with the Iver Johnson. It simply can't go off by accident. And yet its safety is automatic—no buttons—no levers—nothing to adjust—nothing to remember to do to make it safe. Drop it, kick it, thump it, "Hammer the Hammer"—it can't go off accidentally.

Just one way to fire an Iver Johnson—pull the trigger all the way back. At that point only the revolver responds with lightning quickness.

Drawn tempered piano-wire springs make the Iver Johnson always ready for use. And the perfect rifled barrel speeds the bullet straight as a streak of light just where you aim.

Choice of three grips: Regular, Perfect Rubber, Western Walnut.



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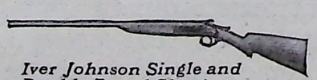

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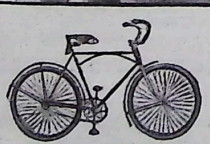

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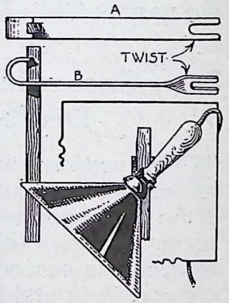
A Clamp that Holds the Lamp in Position

IF working at a vise, it is not only necessary to have enough light, but also to have it where it is wanted. The usual type of electric lamp gives sufficient light, but is unsatisfactory because if too high, it throws a shadow of the worker on his work, and if too low, it is a hindrance.

Every one knows how annoying it is to spend some time arranging the lamp until it is "just right," only to have it slip when jarred.



No screws or wires are in this holder

The accompanying illustration shows a very easily made lamp-holder, by means of which the lamp may be arranged in an instant. The lamp may be raised or lowered without the inconvenience of adjusting screws or wires; will stay in that position; and will be held so that the light falls directly on the work, preventing shadows, and protecting the worker's eyes from the direct glare.

The upright support is a piece of iron of any convenient size; ½ in. wide by ¼ in. thick is a good size. The arm of the holder is a piece of iron about ⅛ in. thick and 1 in. wide and of any desirable length. About 4 in. from one end of the arm an oblong hole is cut so that the upright piece may slide easily through it. The back end of the arm is cut to fit the upright, while the opposite end is cut to fit the lamp handle.

At *A* the arm is shown before bending. The back end is then in the form of a half circle, taking care that the notch in the end lines up fairly well with the oblong hole. The other end of the arm is given a ⅛-in. twist, so that the lamp will be held at an angle of about 45 degrees. At *B* the supporting arm is shown after bending. The supporting arm is then slipped over the upright support. The weight of the lamp produces a clamping effect on the upright, so that any notches, screws, or wires are unnecessary. By lifting up slightly on the lamp, the supporting arm immediately slides freely on the upright.

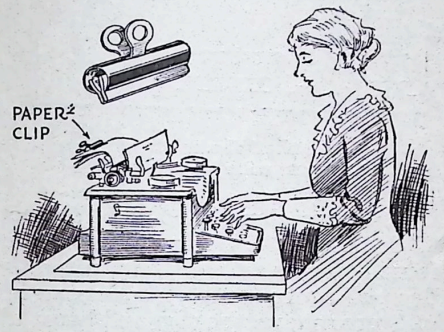
The upright may be set in a heavy base or attached to the work-bench with screws. If the latter method is decided upon, it is advisable to make

the supporting arm with at least one joint, so that it may be swung out of the way if desired.—R. H. CASPER.

How to Keep the Typist's Papers in Order

WHEN typing multiple copies of a letter the stenographer is usually annoyed by the sheets and carbon paper curling up. Try as she will she cannot keep them flat.

Whenever this occurs in our office we attach a paper clip to the end of

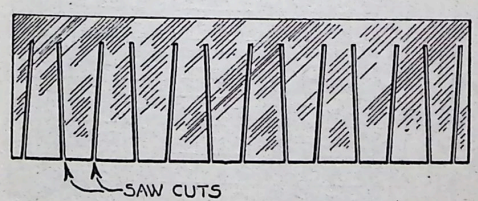


Just try putting a clip on your copy sheets. It will hold them down without curling

the top sheet, which weights the other copies down and permits us to continue the work without further trouble. Try this idea next time you have this difficulty and see how it enables you to go ahead immediately.—M. A. OSBERG.

A Way to Mill Keys from Flat Stock

SHOULD a number of keys have to be made all alike, they can be made on the milling machine, using a thin cutter or a metal slitting-saw. The tapers can be set off on the divid-

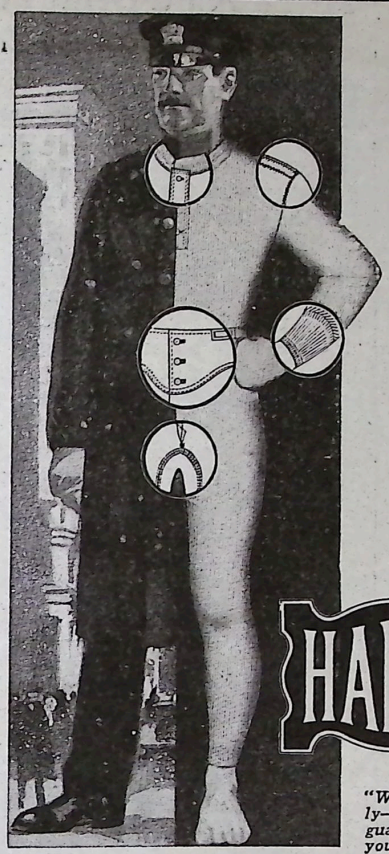


This illustration shows the most economical way of making the cuts

ing scale of the machine, so that they all will be alike.

By arranging the cuts so that the keys will come "heads and tails," there will be a minimum of waste material. All the cuts at one angle can be made at one setting, and another setting made for all the rest of the cuts. The finished flat stock supplied by the steel people lends itself very well indeed to work of this character, as it can be had in any width or thickness, and ground flat and true to the required gage.

After the necessary number of cross-cuts has been completed, it is necessary simply to make one longitudinal cut at the end of the cross-cuts to separate the keys and to remove the burrs.



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Every garment bearing the "Hanes" *national* nameplate returns in wear and in absolute satisfaction far more than you pay for it—more than you ever before got out of an undergarment!

Confidence you will have in every "Hanes" thread, stitch, buttonhole, seam, or reinforcement can never be misplaced. Our guarantee is your safeguard. *It proves our faith in "Hanes"!* It is your protection!

"HANES" underwear is made in heavy weight and medium weight Union Suits and heavy weight Shirts and Drawers. (Illustrated in this advertisement.) The new medium weight Union Suit, carrying the *yellow* label, has been added to meet the demand of indoor men. It is made of full combed yarn and silk trimmed.

"Hanes" Union Suits have the popular snug fitting *tailored* collarette and elastic knit arm and leg cuffs that will not gap; closed crotch that stays closed; flat, unbreakable seams; an extra gusset assures unusual comfort across the thighs; buttonholes last the life of the garment; pearl buttons are sewed on to stay!

Shirts have the snug fitting elastic knit collarette. Drawers have a wide, easy fitting, 3-button sateen waist band that adds so much to the wearer's comfort.

"Hanes" for boys

Buy "Hanes" Union Suits for boys if you seek more warmth and more wear than you ever bought before. This extra-value underwear duplicates the men's Union Suits in all important features with added fleeciness that appeals to the boys—*and to mothers!*

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Warning to the trade: Any garment offered as "Hanes" is a substitute unless it bears the "Hanes" label.

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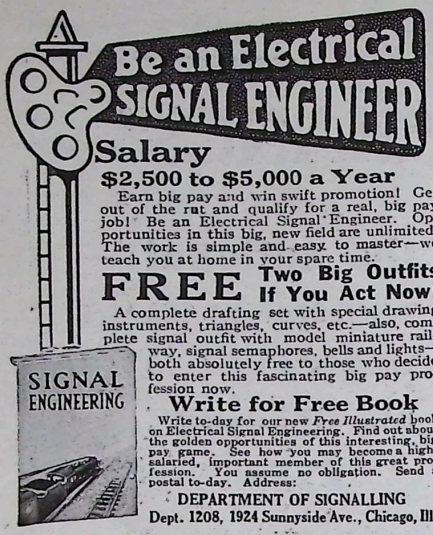

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A Tap-and-Drill Table in a Metal Soap-Box

By Theron P. Foote

EVERY man who shaves himself has his own particular make of soap. I have been using the twenty-five-cent size shaving-stick, and when I finished with the box I always gave it to the baby to play with. The other day I found one on the floor and, putting it in his box of toys, noticed that he had eight similar boxes. With a little thought I have placed a number of those little boxes to very good use as a dirt-proof decimal equivalent and tap-and-drill table for my tool-box.

I first procured a portion of a wooden rod having a diameter of 1 5/16 in. and 3¾ in. long. Finding the

To the man in the shop this tap-and-drill is invaluable

center, I started a small hole, later to be used as a guidance hole for a screw, in each end.

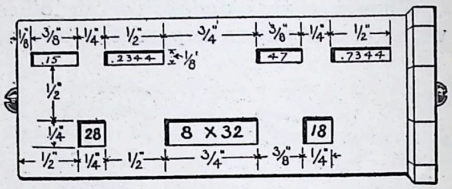
I then laid out in the center of a large sheet of plain white paper a tabulation similar to the one in the accompanying sketch, allowing ⅛ in. for the decimal-equivalent scale and ¼ in. for the tap-and-drill scale. This I filled in with typewritten numerals and then neatly pasted the strip around the wooden block.

Clamp a ¾-in. iron pipe nipple in a vise and placing the soap-box over the end, with a small hammer carefully flatten out the threads. Then mark the box as shown in the illustration and cut out the sections with a sharp cold chisel. Find the center of the bottom and top of the soap-box and drill a hole in each, using a No. 30 drill The wooden cylinder is then placed in the box and a ¾-in. No. 6 round-head nickel screw fastened from the bottom into the guidance hole of the cylinder. This screw should not be drawn up tight, as an allowance should be made so that the cylinder may revolve in the box.

Now fitting the cover on, the screw through the cover into the end of the cylinder should be drawn up tight, so that the cover and cylinder are one.

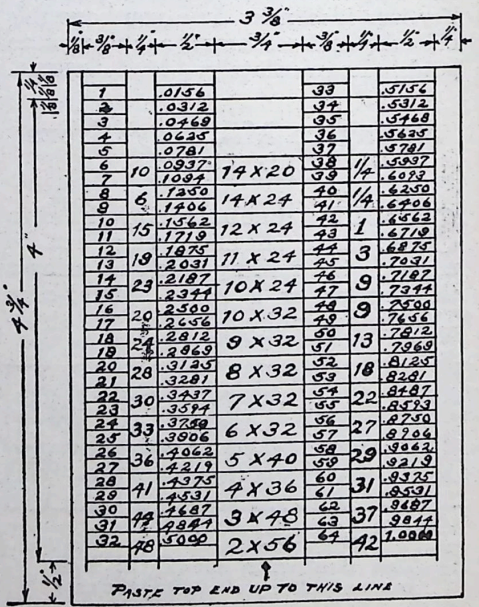
Any loose tension between the cover and box may be taken up by tightening the screw in the bottom of the box.

Revolving the cover shows at a glance the decimal equivalent for any sixty-fourth of a unit in the first four holes, that is, the first and third holes show what part of the sixty-fourth;



Mark the holes as shown here and cut with a sharp chisel

in the illustration the 15 and 47 denote 15-64 and 47-64, while the second and fourth places give their respective decimal equivalent. The second row of figures shows the tap and body drill to be used with a given size of tap, that is, as in the illustration, for an 8 by 32 tap, a No. 28 drill should be used if the material is to be tapped, whereas if an 8 by 32 machine screw is to



1		.0156		33		.5156
2		.0312		34		.5312
3		.0469		35		.5468
4		.0625		36		.5625
5		.0781		37		.5781
6	10	.0937	14 X 20	38	1/4	.5937
7		.1094		39		.6093
8	6	.1250	14 X 24	40	1/4	.6250
9		.1406		41		.6406
10	15	.1562	12 X 24	42	1	.6562
11		.1719		43		.6719
12	19	.1875	11 X 24	44	3	.6875
13		.2031		45		.7031
14	23	.2187	10 X 24	46	9	.7187
15		.2344		47		.7344
16	20	.2500	10 X 32	48	9	.7500
17		.2656		49		.7656
18	24	.2812	9 X 32	50	13	.7812
19		.2969		51		.7969
20	28	.3125	8 X 32	52	18	.8125
21		.3281		53		.8281
22	30	.3437	7 X 32	54	22	.8437
23		.3594		55		.8593
24	33	.3750	6 X 32	56	27	.8750
25		.3906		57		.8906
26	36	.4062	5 X 40	58	29	.9062
27		.4219		59		.9219
28	41	.4375	4 X 36	60	31	.9375
29		.4531		61		.9531
30	44	.4687	3 X 48	62	37	.9687
31		.4844		63		.9844
32	48	.5000	2 X 56	64	42	1.0000

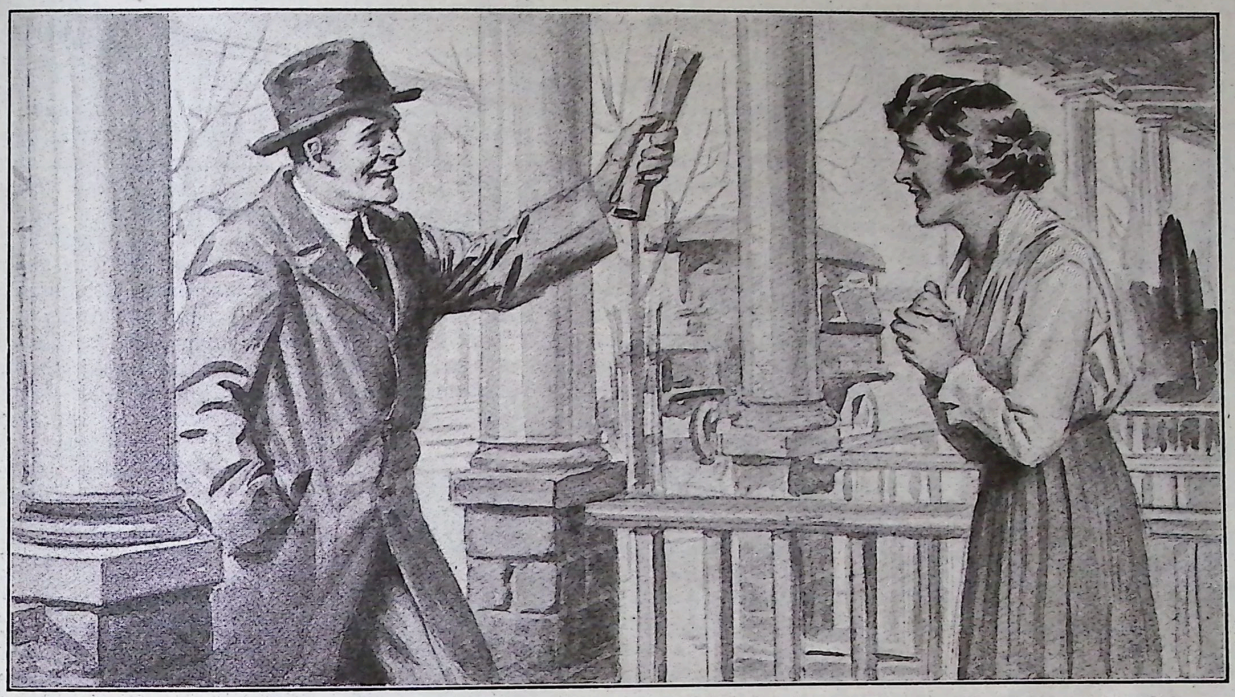
Such a table as this should be pasted on the rotable cylinder in the box

pass through the hole without being threaded, in other words, a clearance hole, use a No. 18 drill.

It didn't cost a cent and it has saved a lot of time and bother. Try it.

Protect Your Garage and Car from Fire

IN spite of every precaution, gasoline is sometimes spilled in the garage or shed in which an automobile is housed and it is not always due to carelessness that the spilled gasoline is ignited. An extinguisher of the squirt-gun type, and filled with carbon tetrachloride or trichlorethylene, shou'd be in every garage.



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7-25-19

Making a Battery-Charging Apparatus

By Francis Raymond

MANY more owners of automobiles would equip their cars with storage batteries for lighting purposes if it were not for the expense and trouble necessary in taking the battery out of the car and having it recharged at the service station. This is particularly true of Ford cars not provided with a storage battery for lighting, and the following method of making a device that may be used in the cellar of the house, or garage, will help solve this trouble for many owners.

The aluminum rectifier, which may be made and used at home, would not cost over five dollars, and its operating expense would be very small compared with the cost of having a battery recharged at a station. Rectifiers of this type have been made and used in various parts of the country with good results.

The rectifier may be kept in the garage and is always ready for use

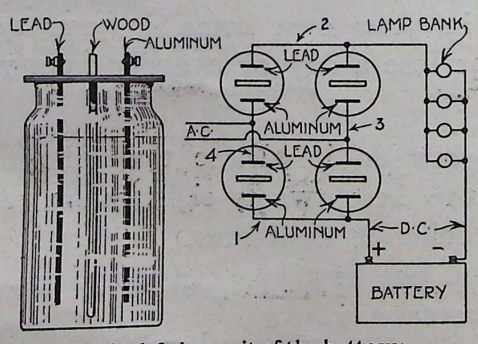
The materials needed are four jars made of glass or other insoluble non-conducting material, 6 inches in diameter by 10 inches high, costing probably about one dollar. Four strips of aluminum, about 1½ in. wide and as long as the jars, are needed, and also four lead or carbon strips as wide as will conveniently go into the jars and of the same length of the jar. A strip of wood or some other non-conducting material is placed between the plates at the top of each jar to prevent the aluminum plates from coming in contact with the lead or carbon plates. One aluminum and one lead or carbon plate is used in each jar and should be an inch or two apart. The jars are then filled nearly to the top with a concentrated solution of common baking-soda in pure water, although it need not be distilled water. Each plate is supplied with a binding-post at the top to which the connecting wires may be attached.

There may be a tendency for the liquid in the jars to get warm and it may become even hot enough to boil. Trouble of this kind can be prevented by having the four jars set in a vat of water so arranged that cold water may enter slowly and the warm water be carried away. A wooden box lined with galvanized iron or painted with a waterproof paint would serve the purpose nicely. If the current taken from the rectifier is not excessive, this cooling-vat may not be needed at all.

To set up the rectifier, place the four jars in rectangular form as near each other as convenient. Place one of the aluminum plates toward the outside of each of two jars and connect by wire; call this wire *1*, as shown in the illustration. Place one of the lead or carbon plates toward the outside of each of the two remaining jars and connect by wire, as at *2*. Connect the remaining lead plates, which should be toward the inner edge of each of the two jars, by wires across to the remaining aluminum plates, which are toward the inside of the other two jars. Call one of these wires *3* and the other *4*. Attach a wire to the center of *1* and another to the center of *4*. These two wires form the circuit taken by the direct current from the rectifier to the lamp-bank and storage battery. Connect the alternating lighting circuit wires at *2* and *4*, providing a switch in this circuit so that the lighting circuit may be shut off when the rectifier is not in use.

As the voltage of the alternating current used will probably be 110, in most cases it will be necessary to introduce resistance on one of the circuits. It may be better to provide this in the charging circuit as shown, but it might be used in the alternating circuit as well. Sixteen or 32 candlepower electric incandescent carbon globes are about as cheap and convenient for this resistance as anything that can be used. They should be connected in parallel and not in series, as shown, thus enabling the variance of the strength of the direct current by screwing the globes either on or out of the sockets.

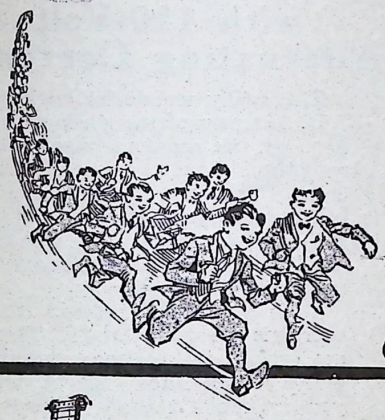
The number of lamps used will depend upon the capacity of the battery that is being charged. From 4 to 6 should be enough for a storage battery of 10-ampere-hour capacity. One can figure that a half ampere will pass through each 16-candlepower lamp that is screwed into the socket, so that when 4 lights are burning, 2 amperes will be passing.

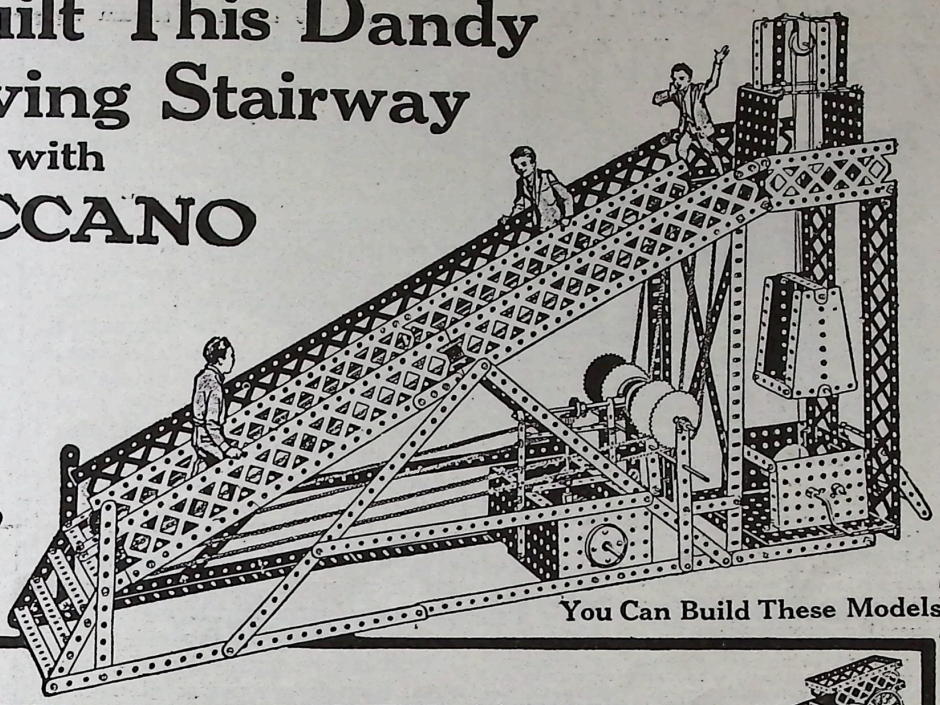


To the left is a unit of the battery; to the right is the wiring diagram

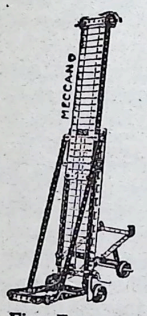
In the beginning of the charge let all the lights be used for two or three hours, then later one globe may be screwed out of the socket, and so on

I Built This Dandy Moving Stairway with MECCANO

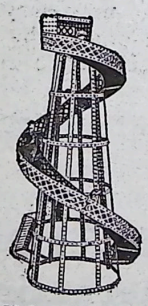




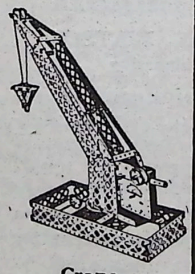
You Can Build These Models



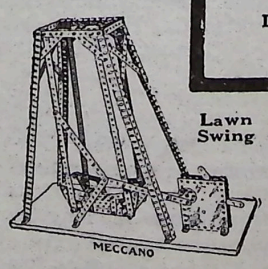
Fire Escape



Helter Skelter



Crane



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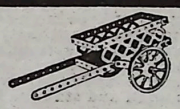
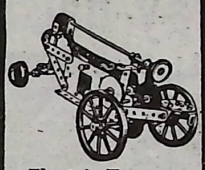
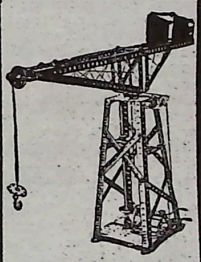


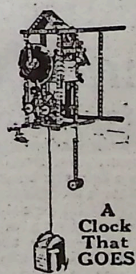
Cart



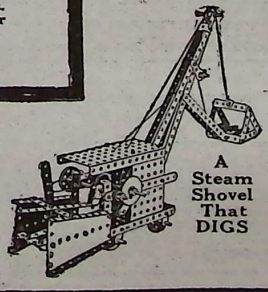
Electric Tractor



Girder Crane



A Clock That GOES



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until the last hour of the charge perhaps one light will be enough. In general, storage batteries should be charged more rapidly for the first hours than later. If the rectifier is kept cool, the battery may be charged at night and thus require but little of the motorist's time and the battery will always be ready for service on the car. There should be a switch in the alternating-current circuit to cut off the rectifier when not in use.

Rectifiers of this type are not of very high efficiency, that is, more current goes in on the alternating side than can possibly be taken from the direct side, but even the cost of charging at home, if it is rightly done, will be less than the price paid at a service station, to say nothing of the convenience afforded by always having the battery ready for service.

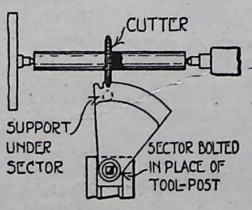
When it is seen that the total cost of this apparatus is less than five dollars, even if all parts have to be bought new, it is obvious that it will yield a big interest on the investment.

It should be noted that the wire which leads from the two aluminum plates that are connected, is the positive wire on the direct-current side and should be connected with pole of the storage battery marked Z. It is also important that pure aluminum be used for the plates. Some aluminum on the market is too impure for good results. The aluminum plates should be at least 1 1/16 in. thick and it might be advisable to have them heavier.

This homemade rectifying device for charging storage batteries is designed to give satisfaction on a 110-volt alternating-current circuit.

How to Notch Sectors on an Ordinary Lathe

A TOOTHED sector is easily notched out on an ordinary lathe. Mark off the tooth positions on the edge of the sector. Mount a milling cutter of the desired form on a mandrel



Showing a simple way of notching a sector on a lathe

in the usual way. Bolt the sector to the tool carriage, using a bolt that passes snugly through the hole in the hub with the head in the tool-post slot.

The teeth can be milled out one after another. If great accuracy is required, a gear with the proper tooth spacing may be attached to the sector. and used as a guide in connection with a stop to enter the gear teeth.

Any one who has a lathe in his shop may also employ the method described in the foregoing for cutting the teeth of small special gears which he may require in constructing models of machinery.

Two Great Books on Alternating Currents

I

Experiments with 110-Volt Alternating Currents

This really wonderful book by J. D. Adams explains what can be done by the amateur electrician with the 110-volt commercial circuit. It shows how the 110-volt commercial circuit may be handled with perfect safety and without involving the expense necessary to maintain a power supply.

It is written so clearly that everyone can understand it. There are profuse illustrations and diagrams which show exactly how you can make these experiments yourself.

The only way to gain a thorough understanding of electricity, as it is used commercially, is by direct personal experiment. The knowledge thus gained is of vastly more value and importance than that acquired from the performance of the stereotyped series of battery experiments so uniformly described in the text-books. The many experiments described in this book were all performed at home and not in a machine shop or laboratory. The apparatus involved was necessarily made as simple as possible consistent with the securing of striking results.

Fully Illustrated. Price Postpaid, $1.75

II

Construction of Small Alternating Current Motors

By PROF. A. E. WATSON
Brown University

This book contains complete instructions for building small alternating current motors in several sizes. The designs will be found in harmony with those of the very best manufacturers and they can be worked out by the amateur for making useful instruments.

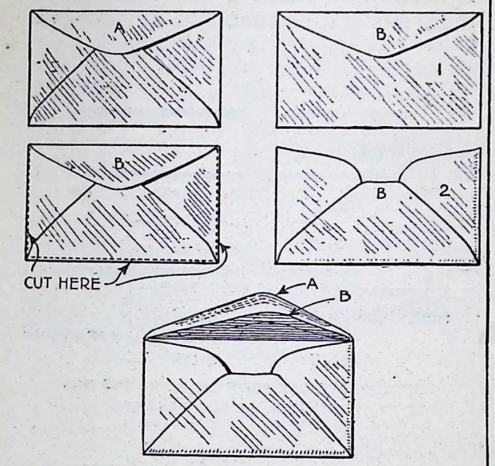
Some of the subjects taken up are "Characteristic Features of Alternating Current Motors," "Construction of a One-Half Horsepower, Single Phase Induction Motor," "Procedure in Testing and Using an Alternating Current Generator or Synchronous Motor." Clear, concise directions and careful drawings are features of this book.

Fully Illustrated. Price, $1.75

Popular Science Monthly
225 West 39th Street, New York

An Envelope Trick, or the Mysterious Message

THE "gentleman from the audience" being shown an apparently empty envelope, is asked to place a message inside it, then seal the envelope. This he does, and is amazed to see the performer immediately tear open the envelope and draw out a return message which has, in some mysterious manner, replaced the original note. The method is as follows.



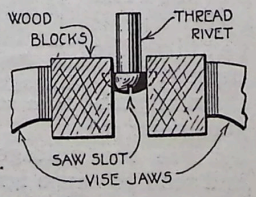
This trick is performed by inserting a cut envelope inside a whole one

Two envelopes *A* and *B* are used. They are precisely the same shape, size and color, but *B* is cut around three sides, which permits it to fit nicely into *A*. After trimming, *B* is really in two sections, *1* and *2*.

After placing *B* in *A*, the reply is inserted between *A* and *B*, toward the address side. The flap of *A* is now gummed to flap *B*, and a seemingly empty envelope is ready to be shown the gentleman from the audience.

Making Machine Screws from Rivets

IN an emergency, a very respectable machine screw can be made from a round-headed rivet, either brass or iron. All that is necessary is to thread the shank with the stock and die, and with the hacksaw make a slot in the head. A convenient way to hold a short rivet for threading is to place it between two blocks of wood and put the blocks in the vise, pressing the rivet head into the wood with as much force as is necessary to prevent it from turning.



A machine screw made from a round-headed rivet

A little powdered rosin will help a good deal in holding the rivet stationary. The blocks should be made of hardwood.

Make This Test

Watch how your teeth respond

All statements approved by authorities

This ten-day test has shown to millions the way to whiter, safer teeth. It is a free test—you should make it. No other method known can do what Pepsodent does for teeth.

To end the film

The object is to fight the film, which dims the teeth and causes most tooth troubles. Dental science has worked years to do that.

Film is that viscous coat you feel. It clings to teeth, enters crevices and stays. The ordinary tooth paste does not combat it satisfactorily, so brushing leaves much of it intact.

It is the film-coat that discolors, not the teeth. Film is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea. Thus all these troubles have been constantly increasing, despite the tooth brush.

Now we combat it

Dental science, after years of searching, has found ways to combat film. High authorities have proved them by clinical and laboratory tests.

The best dental opinion now approves these methods. Leading dentists everywhere are urging their adoption. Millions of people, as a result, now employ them daily.

The methods are combined in a dentifrice called Pepsodent. And a 10-Day Tube is offered free, so all who will may quickly know how much it means to them.

Five Much Desired Effects

One ingredient of Pepsodent is pepsin. Another multiplies the starch digestant in the saliva to digest the starch deposits which cling and form acid.

It also multiplies the alkalinity of the saliva, to neutralize the acids which cause tooth decay. Two factors directly attack the film. One of them keeps teeth so highly polished that film cannot easily adhere.

Pepsodent combines the best that modern science knows to combat the great tooth destroyers. It has brought a new era in teeth cleaning.

Watch it act

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth whiten as the film-coat disappears.

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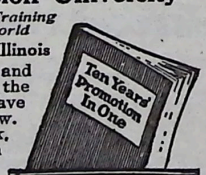

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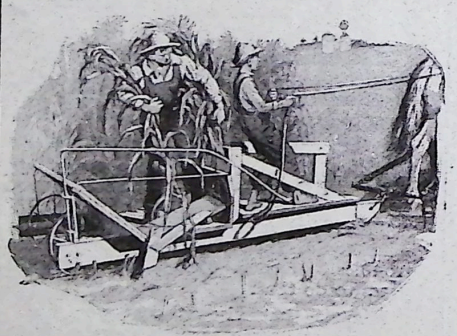
Harvesters Can Be Made on the Farm

CORN is one of America's big crops, and its magnitude alone would suggest the difficulty of the task in harvesting the immense acreage. Moreover, corn-harvesting is limited to a few days if the feeding value of the fodder is to be completely realized. Speed is essential to cutting the corn for silage or fodder. Hence the value of a platform harvester which can be purchased or made at home. The illustration shows the one-row harvester. Two men with a platform harvester and one horse can cut and shock as much corn in a day as three men cutting by hand.

This machine is a sled platform or a platform mounted on small wheels, with knives attached for cutting the stalks. Homemade platform harvesters can be mounted either on sled-runners or on wheels. The harvester is pulled by one horse and cuts one row at a time. Two men ride on the platform to catch and support the stalks as they are knifed. When cutting corn



Speed is essential in the cutting of corn crops, and here is the machine that will attain that speed

for fodder, the horse is halted when the shock is reached, the operators carry the cut corn to the shock, return to the cutter, and proceed toward the next shock.

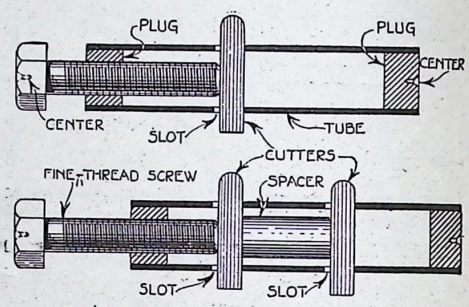
The original cost of a platform harvester ranges from twenty to fifty dollars, depending on the make-up of the machine. Devoid of many movable parts, the repair bills are almost negligible. Sharpening the knives usually represents the expense of upkeep. It is estimated that the machine can be operated at a cost of twenty-five cents an acre. Cutting corn with a corn-binder is much more expensive, taking no account of the expense of acquiring a corn-binder.

Making a Good Boring-Bar from Steel Tubing

A VERY simple and satisfactory boring-bar can be made from a piece of steel tubing, 2 plugs, a long bolt, and a piece of steel for the cutter.

A slot is cut at any desired place in the tube to hold the cutter, the slot being just large enough to allow the steel to pass through. One end of the tube is plugged and the plug centered for the back center of the lathe. The other end is also plugged and is drilled and tapped for a fine-threaded steel bolt. The center for the headstock end is formed in the head of the bolt. The cutter is placed in position in its slot and the bolt screwed in.

This idea can be carried further if it is desired to make a bar with two or more cutters, so that two or more cuts



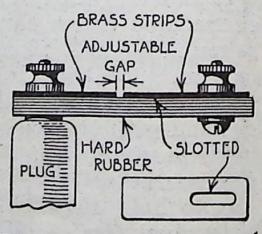
One boring-bar may be used for one or more cutters, as shown here

can be taken at the same time. If two cutters are required, for instance, make two slots at the desired distance apart. The screw will come against the nearest cutter as before, and between the first and second cutter there is a round bar that will be forced against the second cutter when the first cutter is jammed against it by the screw.

Any number of cutters might be used, or a single cutter put in any place on the bar, by using a number of slots with suitable rods or distance pieces between them.

An Emergency Spark-Gap for a Weak Cylinder

WHEN a certain cylinder misses regularly, it is an easy thing to locate, but when every cylinder misses, then one is very apt to use harsh language. The illustration shows how to make a cheap spark-gap which can be applied to each of the spark-plugs. A glance at the gap shows whether that particular cylinder is getting the current. Then again, a spark-gap seems to increase the voltage of the current and tend to cause ignition, even if the plug is sooted or short-circuited.



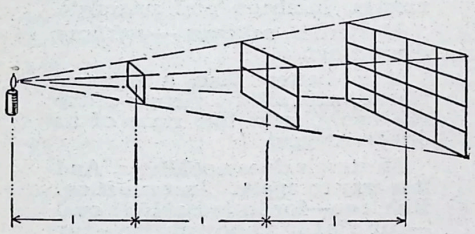
Emergency spark-gaps made from strip copper and fiber

The device is made from two pieces of strip copper, or brass, about ¼ in. wide; one bolt or binding-post, and a strip of fiber or hard rubber. The illustration shows how these parts are assembled. Be sure to slot one of the brass strips so that it can be slipped backward or forward to adjust the gap.

The Square of the Distance Explained by Geometry

IF the rays from a single source of light are allowed to fall upon screens as indicated in the illustration, the amount of light which the first screen receives would cover the surface of four screens of the same size placed at double the distance. This fact is made clear by drawing the lines through the corners of the screens as shown.

Furthermore, since the light is spread over four times the surface at double the distance, the intensity of the light is reduced to one fourth. That explains why lights grow dim so quickly as we go away from them and so rapidly increase in intensity as we approach them. In technical language, the light is said to vary inversely as the square of the distance. Thus, if the distances are 1 and 2 units, whether feet, yards, or miles, the intensities are in the inverse ratio of the



Geometrical reasons for the ratio of diminution of lighting power with distance

square of 1 to the square of 2; or inversely as 1 to 4. In other words, the intensity is one fourth as great when the distance is doubled, just as the drawing indicates.

This square of the distance idea is met with so frequently in scientific work that the study of it in its various phases is important, particularly to the youthful experimenter or mechanic who likes to know the reason for things instead of blindly applying rules and formulas. All forms of energy radiating from a center are governed by this law.—H. C. RIDGELY.

How to Square a Timber by Reflection

THERE are times when one wishes to square a timber and has no square at hand. To take chances on squaring by the eye alone is risky, but here is a way that it may be squared by the eye and still run a good chance of making the cut square enough for all practical purposes.

Look at Fig. I. This shows the saw placed across the timber as nearly square as possible by the aid of the eye alone.

To do this properly, use a saw that is polished so the reflection of the timber can be seen easily. Now, tip the saw from left to right and change the angle of the teeth with reference to the sides of the timber until, with the blade held as nearly perpendicular as

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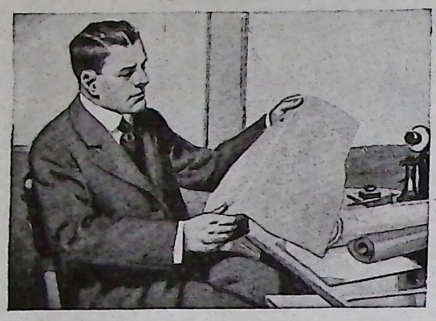

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possible, the image of the edges of the timber will follow the *real* edges in a perfectly straight line. When this condition occurs, it will mean that the saw-blade is at exactly right angles to the timber. If the reflected sides do not follow the original sides in a straight continuous line, you may feel sure the saw is not at quite a right angle.

Of course, remember that the blade must be held perpendicular at all times while making the cut to sever the timber properly between top and bottom face as well as across.

A method of mitering at a 45° angle is illustrated in Fig. 2. This is a trifle more complicated, but nevertheless is one that can be mastered quickly, once understood.

First, make a mark *A* across the board which cuts it square. Then place the farther teeth of the saw at the point where this mark cuts the outer edge of the board *X*. Now move the nearer teeth of the saw away from the mark so it touches the inner edge of the board as near a 45° angle as

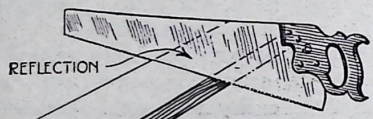

FIG. 1

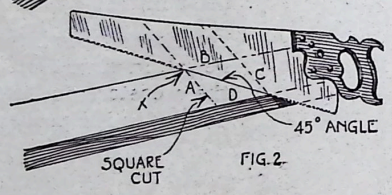

FIG. 2

In the absence of a carpenter's square you can square a timber by reflection as shown in the drawing

you can judge. Hold the saw perpendicularly and look at the square formed by the lines *D* and *A* on the board itself and lines *B* and *C* in the reflection of the cut *A* and the farther edge of the board. If these four lines form a perfect square, you may feel sure that the saw is crossing the board at an angle of 45°. Look directly *down* upon the board and slightly to one side of the saw when viewing this reflection.

While these methods may not be correct enough for fine carpentering, they will suffice for heavy work.

First Aid for the Flash-Light Battery

WHEN one is in most urgent need of an emergency light, it often happens that the old flashlight is "dead." The following first-aid treatment has often saved such a situation:

Remove the battery and slip the individual cells out of the cardboard tube. Take out the bulb and with it test each of the three cells, completing the circuit by means of a knife-blade or some other convenient piece of metal. It will frequently be found

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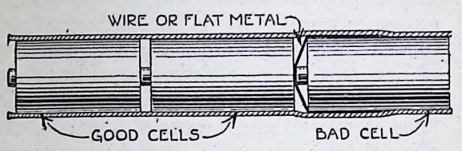
that one of these small cells has deteriorated more than either of the other two (especially if its zinc covering is eaten through in places). Replace in the battery tube the two cells that will individually cause the bulb to light feebly under the above test. Now bend in the form of a U a small piece of wire or a convenient strip of metal and place same over the end of the exhausted cell. This should now be inserted in the battery tube so that the



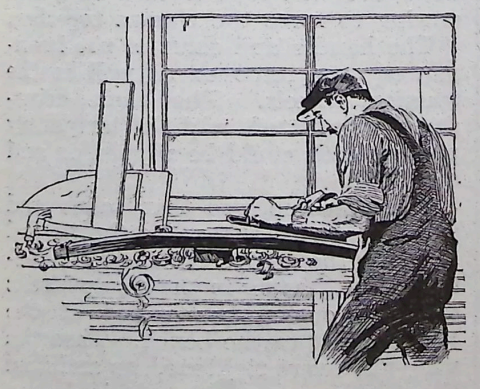
The exhausted cell is short-circuited and merely used as filler

final arrangement is as illustrated in the illustration.

Of course, the effect is of short-circuiting the dead cell and of using it only as a "filler" in the battery tube. Its resistance in circuit stops the current otherwise available from the two better cells. With this first-aid arrangement, however, sufficient light can often be obtained to supply the emergency.—M. M. ELLIS.

The Right Way to Plane a Curved Surface

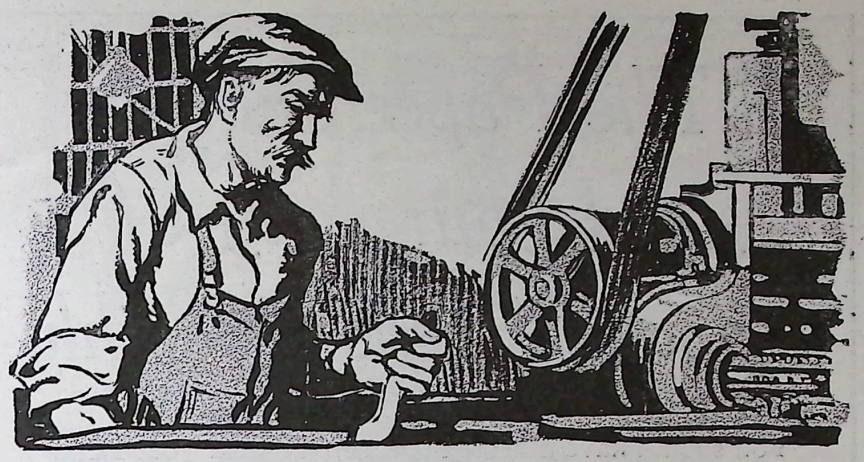
A PIECE of wood can be planed with a surface curved lengthwise, using a straight plane, if the trick is known, and if the wood is thin enough to be somewhat flexible. Simply fasten the wood down to the bench with a support under it so that the under side will have the curve that is required on the top. Then plane the top perfectly straight. When the wood is released, it will spring back to its original form



If the wood to be planed is held as illustrated in the drawing, the result will be a concave surface on the upper side

and one side will be concave and the other straight.

The same plan can be followed in metal work, where only a slight curve is needed. Even cast iron can be sprung a little, and the piece can be fastened down on the bed of the planer or shaper and planed while sprung, giving a curved surface when the piece is allowed to resume its natural form.



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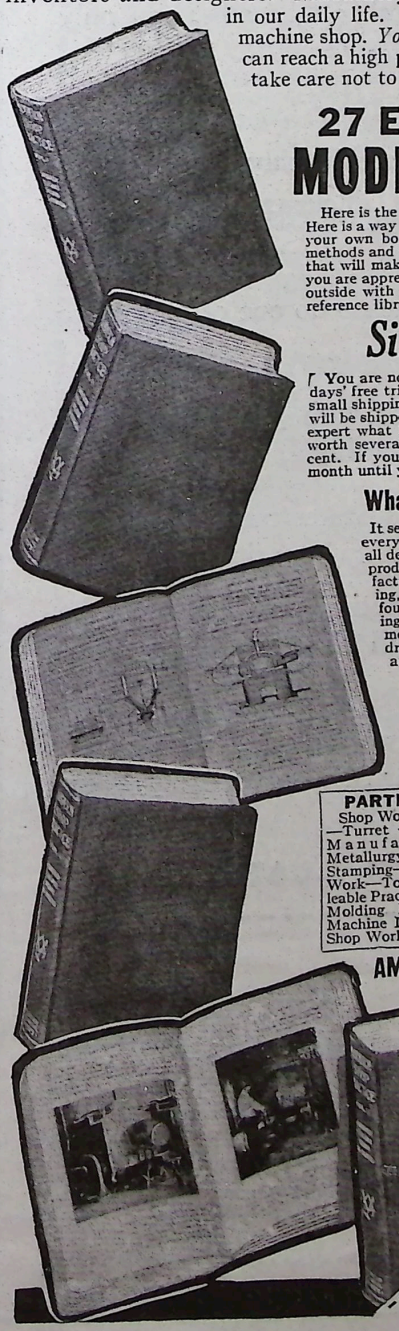

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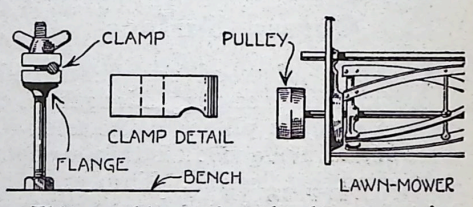
An Efficient Method of Grinding Lawn-Mowers

EARLY fall is the time that the lawn-mower should be cleaned, sharpened, and oiled to be put away for the coming season. At this time, too, the average small machinist is crowded with work along that line and perhaps finds it hard to keep up with the demand, especially at the fag end of the summer season. One machinist doubled his mower-sharpening capacity by establishing a fixed bench in his shop for the sole purpose of lawn-mower grinding, and has gone about it in the following manner. He uses power and can sharpen them almost as fast as his helper can place the machines on the bench and take them away.

First he arranged two heavy upright bolts in the bench about 15 in. apart. A flange was fitted to each one as shown. Then two pairs of clamps were turned out of soft iron stock.

Each section of a pair was drilled in the center with a hole which was a loose, sliding fit for the bolt. One side of each section was gouged out in a shallow groove. Then a section was slipped over each bolt, grooved side up, and rested on the flange. The second sections were then



This machine spins the lawn-mower's blades so that they will be uniformly and quickly sharpened

slipped over the bolts, grooved sides down. Then a wing-nut was threaded down over the tops of each bolt, and serving to force the clamps together.

The handle and shaft of the lawn-mower were removed as well as the traction wheels. The blade drive-shaft was fitted with a temporary pulley which could be slipped on and off at will.

The machine was then taken and placed upon this stand so the tie rod between the two sides rested in between the grooves in the clamp blocks and the cutting-bar rested at the bottom next to the bench. Then the wing-nuts were tightened up and held the machine securely in position.

The pulley was belted up to the source of power so the action on the blades was to reverse their motion from normal. It is necessary that the clamps are held high enough by the flanges so that the disks clear the bench by an inch or more.

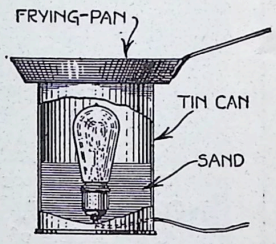
If the cutting-bar adjustments are under the bar instead of over it, the clamps can be loosened, the machine swung up from the bench until the screws can be reached, and then let down and reclamped.

The sharpening is done by setting the cutting-bar so it touches the blades hard enough to slightly jam them, then starting them to revolve about thirty to forty revolutions a minute, reversed in motion as before stated, and touching them occasionally with a brush dipped in some valve-grinding compound.

It will not be many minutes before the blades are evenly ground their entire length and all touch the cutting-bar with equal pressure.

The Electric Lamp as a Cooking Device

AN egg can be electrically fried and other small cooking done with the aid of an ordinary lighting-bulb—the bigger the better—and a tin can. Put the bulb in the can, as shown in the illustration, and set the cooking utensil on top, and wait for the result. Less heat will be wasted if the outside of the can is covered with a layer of asbestos. With a large can bent to an oval shape, and two bulbs, even better results can be obtained.—HOWARD GREENE.

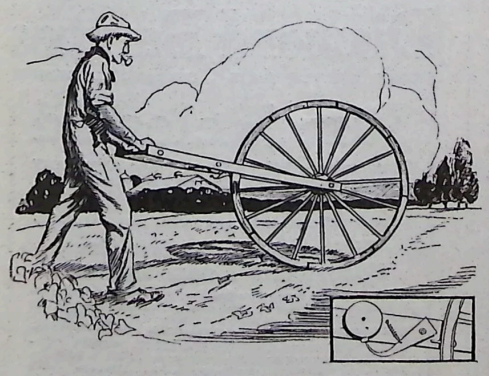


Frying eggs with an electric-light bulb

Measuring Distances by Means of a Wheel

IT takes two men to stretch a tapeline when measuring land, but one man can do the job quicker and better with an old buggy wheel rigged up properly.

Make two shafts out of 3-in. scantling about 6 ft. long. They are attached to the wheel-hub with an axle made of a long bolt. The opposite ends of the shafts are spread and a round piece of wood inserted about 18 in. long for a handle. A second spreader can be inserted halfway down if desired.



In running over the ground, the wheel measures the distance and rings a bell every so many feet

The sketch shows roughly how a bell can be rigged up to strike at each revolution of the wheel. A pin projects from the rim of the wheel and

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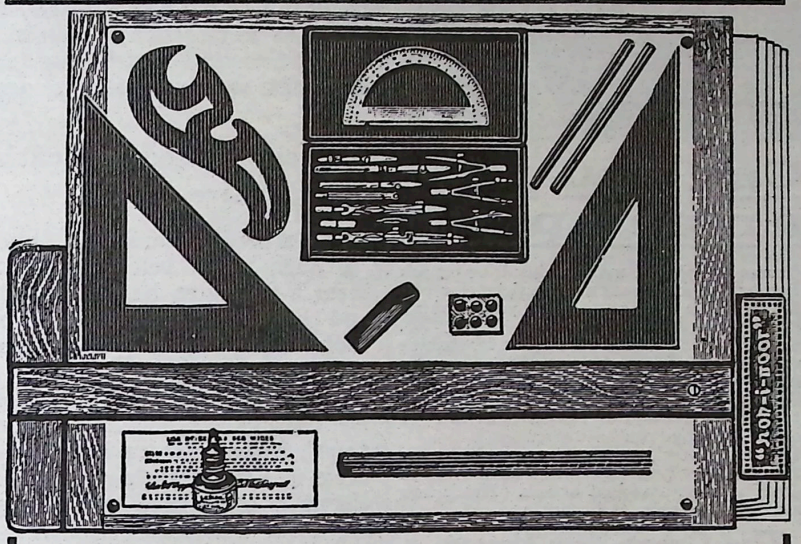

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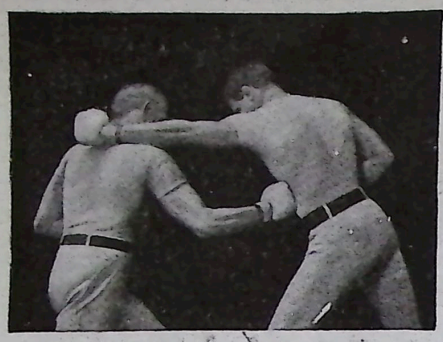

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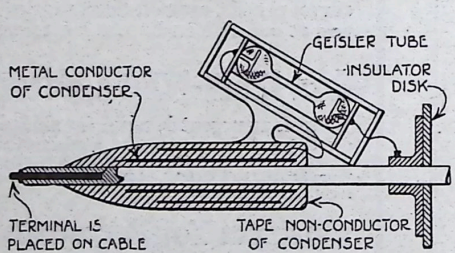
strikes the hammer, pulling it back. When the pin passes, a spring pulls the hammer back and strikes the bell.

Measure the distance around the rim of the wheel and divide into equal parts so that short distances can be computed. When the pin is just ready to ring the bell, a mark should be at the very bottom of the rim.

Each time the bell strikes means one revolution or so many feet traversed.

A Testing-Rod Indicating Live Cables

TO make sure that wires are absolutely "dead" before working upon them, a Rochester, New York, railroad and lighting company is using a cable-tester. This instrument consists of a condenser and a Geisler tube mounted on a long rod. The instrument is used by holding the contact point on the cable to be tested. If there is a distinct glow between the electrodes of the tube, then the operator knows that the cable is alive and that it should not be handled. To make this positive, tests are made in immediate succession on a live cable, on the one supposed to be dead, and on the live one again.



If there is current passing through the wire, this instrument tells the tester that it is dangerous to work upon it

The condenser, which is mounted on the tip of a test-rod, consists of two metal cylinders separated by "linotape" insulation. As the area of the cylinders is small and the distance between them is comparatively large, the capacity of the condenser is very limited, and it will have a high impedance which will limit the current passing through it. One electrode of the Geisler tube is connected with the outer cylinder of the condenser and the other electrode is connected with a binding-post on the rod shield.

Worn-Out Saws Still Have Their Uses

ONE of the large manufacturing concerns uses old band-saws, which were formerly thrown on the scrap-pile, for lining flumes for sand and gravel.

The old blades have been found so well adapted to this use, owing to their hardness, that the manufacturers referred to not only use up their own old saws, but purchase blades discarded by other concerns. They last three or four times as long as bands of the average structural steel.

SOMETHING NEW

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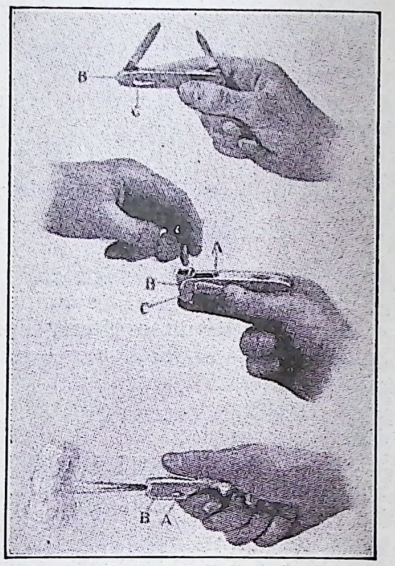

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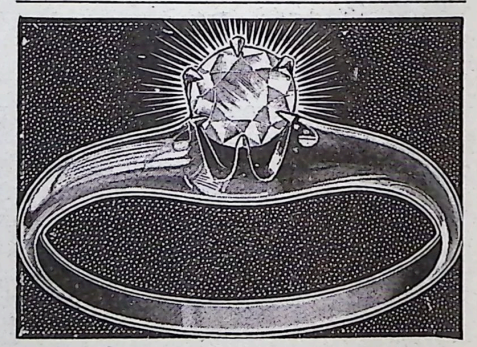
Popular Science Monthly, 225 West 39th St., New York



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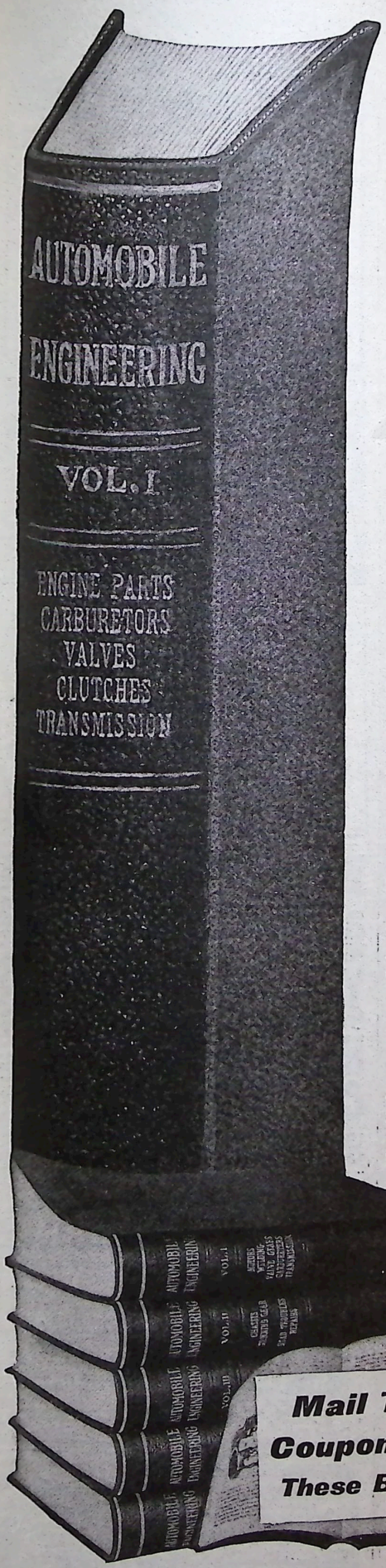

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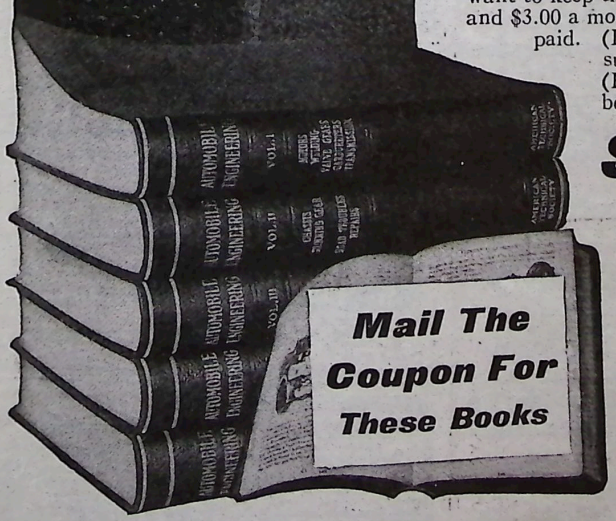

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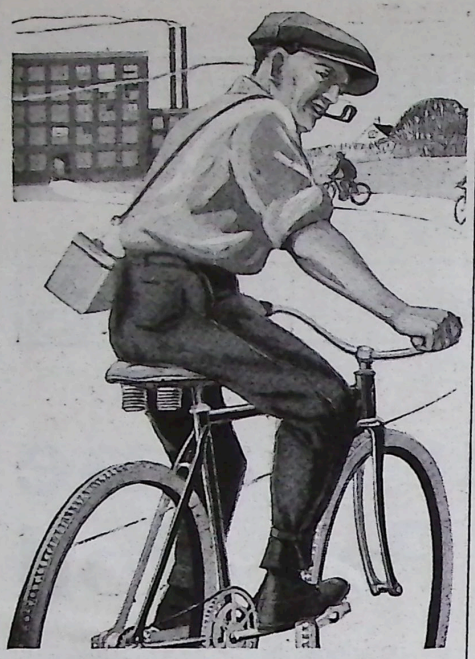

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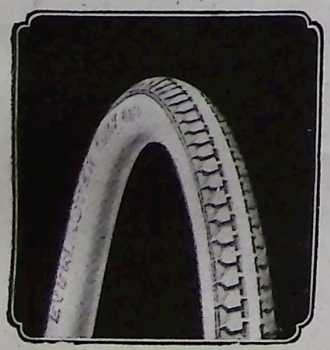

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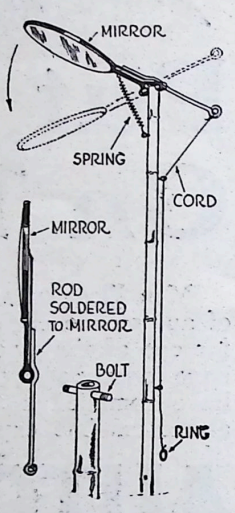
LONG-LIFE KOKOMO BICYCLE TIRES

A Mirror to View the Inside of Elevated Objects

FOR inspecting the condition of inverted lights, high shafting, house gutters, or any object at considerable height which is in such a position that it cannot be viewed from the ground, the mirror herein described will be found useful.

Procure a round automobile mirror of the style shown. Solder a rod to the back which will extend beyond the socketed end nearly as far as that end is from the mirror. Fit the end of a pole with a bolt through the stock to which the socket of the mirror can be bolted.

Set up the nuts lightly so the mirror will swing freely but not loosely. Then attach a cord or wire to the end of the rod and lead down the pole through eyes to the hand. A finger ring at the end of the wire will facilitate pulling.



This rod and mirror will enable you to see the inside of elevated objects

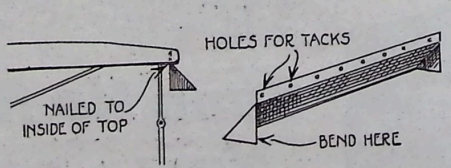
Opposite the cord set a light spiral spring between the mirror shank and the pole. A light bamboo pole or fishing-rod can be used.

The mirror is raised to the desired position and the angle altered by a gentle pull on the cord so the object can be seen.

How to Make a Rain Visor for Your Automobile

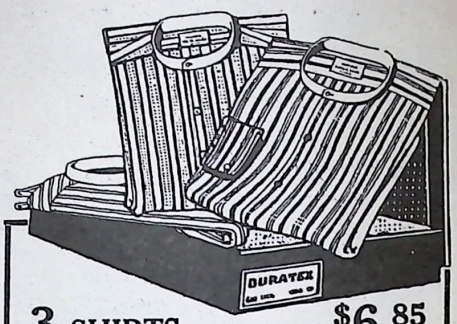
WHEN it rains against the windshield the view of the road is uncertain and chances of accident are increased. Windshield cleaners are good, but they keep one working.

This visor has been devised to prevent the elements from striking the glass at all and is a great help to drivers in stormy weather. As most automobilists keep their tops up during winter, it can be fastened permanently in place, for that season at least.



Attached to the top of your automobile, this tin visor prevents rain or snow from fogging your vision

Cut out a piece of sheet tin the desired length and so it can be bent about as shown in the perspective sketch. The top edge follows the line



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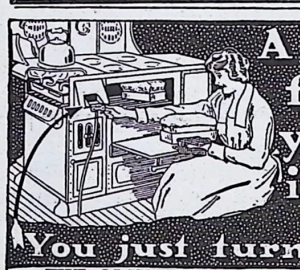

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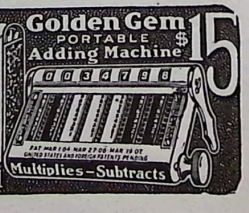

Agents wanted

Multiplies—Subtracts

of the windshield edge of the visor, and should be punched with several holes so that it can be tacked to the inside of the front bow of the top.

Make it just low enough so that it will ward off the snow or rain, but not too low to prevent the driver from watching the road. Be sure the side shields come as close as possible to the glass without touching, as they will help to keep drafts from sucking in the snow or rain at the sides.

When enameled a suitable color to match the car, it will not be unbecoming or conspicuous in the least.

Numerous Uses for the Electric Iron

THE electric iron used by the housewife is like the electric fan—it has many other valuable uses than that for which it was intended.

The writer, returning from an automobile trip, found a large gap the size of a silver dollar cut in one of the tires.

Not having any portable vulcanizer on hand, the gap was cleaned, filler applied, and the electric iron set over it to vulcanize the patch. Needless to say it was whole again in a very short time. (Fig. 1 at *A*.) In the illustration an inner tube at *B* is

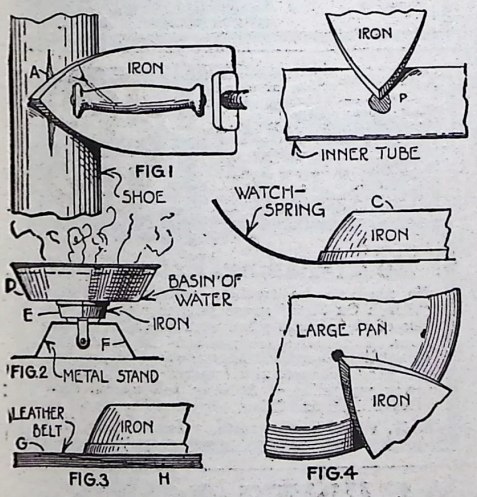

Fig. 1. The iron vulcanizing an inner tube. Fig. 2. As a water-heater. Fig. 3. Drying a glued belt. Fig. 4. Soldering a tin pan

being treated likewise. At *C* the iron is shown removing the temper from a watch-spring so that it may be bent and punched. In Fig. 2 the electric iron is acting as a water-heater; *D* is the pan, *E* the position of the iron, and *F* the little metal stand upon which the iron is set upside down. Figure 3 shows the iron drying a freshly made leather-belt lap. At *G* and *H* are seen the lap ends of the splice.

Figure 4 shows the electric iron soldering a large pan. The dark spots at the bottom are small rust holes which caused the tub to leak. By the use of soldering wire cut in short pieces and driven into these holes, the iron will melt it slowly and make a rivet which will plug the holes tight.

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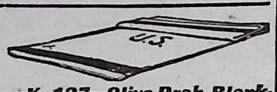

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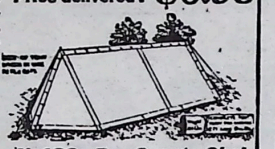

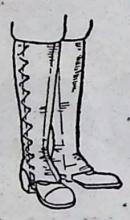

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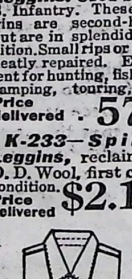

K-229—Leather Protector for above axe to be attached to belt. **Price delivered . . 65¢**

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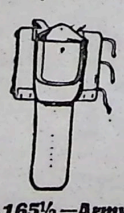

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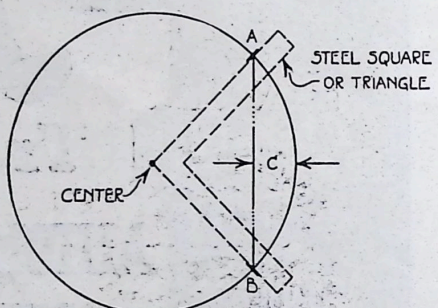
A Short Cut to the Circle's Circumference

HOW often have you wished that you could get fairly accurately the circumference of a circle quickly without a lot of figuring?

The following short cut is especially valuable to the sheet-metal worker and to others as well. Suppose we were laying out a sheet-metal duct of circular construction and had drawn a circle to denote the cross-section. Take a steel square or a large triangle—it doesn't matter which; one will do as well as the other—and place the corner of the angle on the center of the circle as shown in the illustration. Then make a mark with a pencil where the sides of the angle cross the circle



Here is the shortest way to tell the circumference of a circle

outline. These marks we will call *A* and *B*. Now draw a line, using a straight edge from *A* to *B*. This line, as we all know, is the cord of an arc. From the middle of this cord measure to the extreme outside of the circle line. This distance we will call *C*. We now have all the necessary data to work with.

The formula is very simple: three times the diameter of the circle plus the distance *C* equals the circumference. If we take, for example, a 5-in. circle and have found by measurement that the distance *C* is a shade less than ¾ in. Three times 5 plus ¾ gives us 15¾. To check this up we find that by using the standard formula πD, which is 3.1416 times the diameter, we get 15.71, so that by using the short method we have an error that is negligible.—FRANK W. HARTH.

Electrocuting Four-Footed Chicken-Thieves

COUNTING my flock of chickens every night for a week I found that fifty had utterly disappeared from the henyard in that time. This yard had a five-foot fence all around it, but I noticed that it was slightly bent down on the side away from the house. I concluded from the many feathers scattered about the yard that a four-footed thief was at work.

A few months previous to losing the chickens I had installed a small electric-lighting plant in my home. This plant was operated by a water-wheel set in a stream about four

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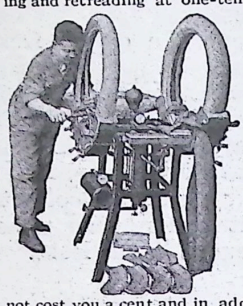

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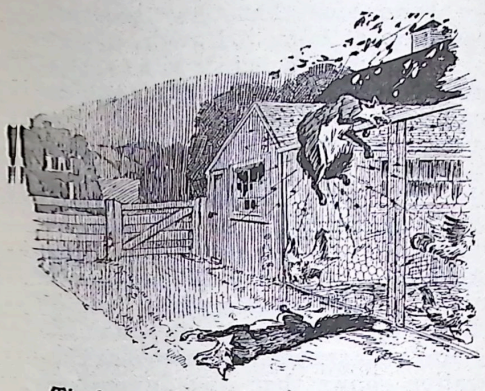
hundred yards from my home, the plant generating about thirty thousand volts.

Having some copper wire left over I ran two wires around the top of the



The foxes trying to jump the wire fence were thrown against the live wires put there for the purpose and electrocuted

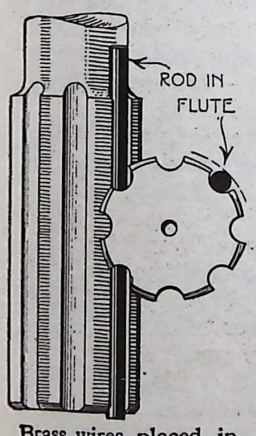
fence, of course making the necessary connection to send the electric current through them.

Just before retiring that night I turned on the full current from my power plant. When I awoke the next morning, there were three foxes stretched out, dead, beneath the place where the fence was bent over. Since that time my chickens have all been accounted for.—L. W. FLETCHER.

Enlarging the Bore of a Reamer

A MACHINIST recently showed me a trick with a reamer that may be useful to others. He desired to ream out a hole in steel to a certain diameter, but the reamer nearest the size desired fell short a small fraction of an inch. To make this reamer sufficiently oversize to meet the situation, he resorted to the following expedient:

He took several pieces of small round brass wire or rod and placed them along the flutes of the reamer on one side. Then he drilled a duplicate of the hole he intended to ream and experimented with the expanded reamer until, by removing or adding pieces of rod, he filled out the flutes just enough to force the reamer over to one side sufficiently to ream out a little more metal. The rods were of soft metal and did not affect the roundness of the hole.



Brass wires placed in the reamer will enable it to bore a larger hole

To force the reamer to one side the rods must be sufficiently large, of course, to project beyond the sides of the cutters of the reamer.

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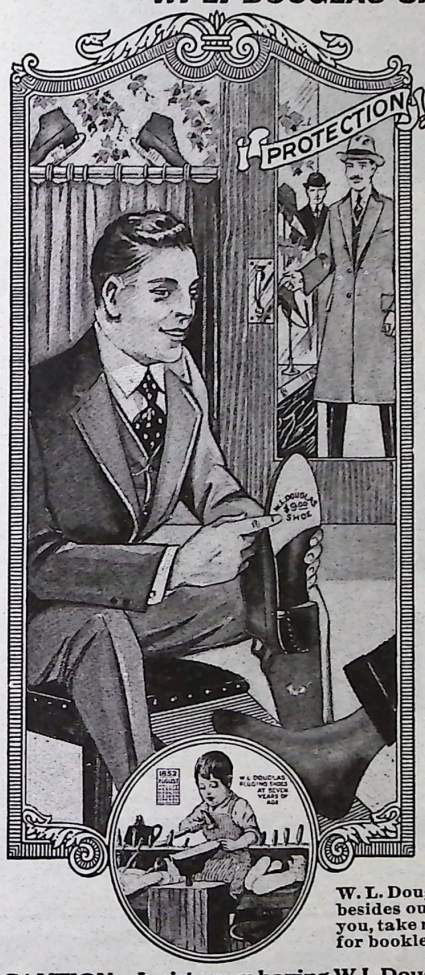

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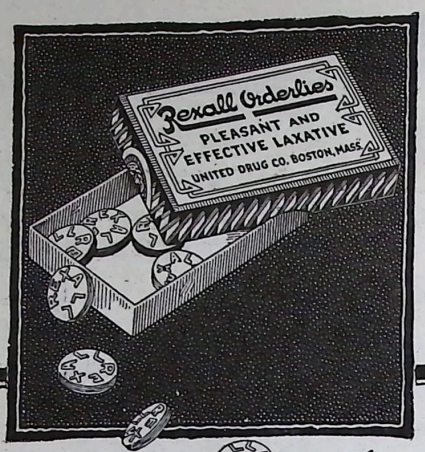

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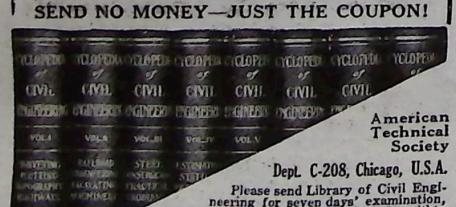

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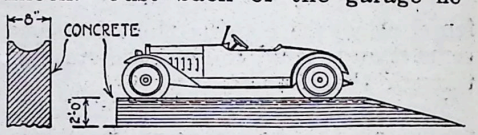
Concrete Supports for Work Under the Car

THOUSANDS of car-owners take their cars to the garage and pay for little jobs that they themselves could do at home. But the thought of sliding under a chassis with a twelve-inch clearance and attempting to make satisfactory repairs keeps them from trying it.

Some few thoughtful ones provide their garage with a pit whereby this work can be done either in a sitting posture or on bended knee and it is seldom that cars which come to rest over a garage pit every night lack for the simpler attentions due them.

And yet another method: The illustration shows that used by one car-owner who itched for a wrench and screwdriver every time he heard a knock. Just back of the garage he



This concrete support set in back of the garage enables the owner to work on his car without lying on his back

dug two trenches about 4 ft. longer than the wheelbase of the machine, 8 in. wide and 18 in. deep. Forms of wood were arranged above the ground at a 2 ft. height and both filled with concrete. The forms were filled to the top at one end, but tapered off at the other as shown, care being taken to see that the level portions were 1 ft. or more longer than the wheelbase of the car.

The concrete was poured rather thin and after thoroughly tamping, the top of each wall was scooped out to a depth of 3 or 4 in. and slightly wider than the diameter of the tires on the wheels.

As seen in the drawing, the notches in both walls terminate abruptly opposite the sloping approach, and gradually diminish in depth at the other end. Thus it is easy when driving the car on to the supports to stop at the desired place—namely, with the front wheels against the end of the depressions. If desired, the notches may be made slightly deeper at the points on which the rear wheels will rest, to prevent any chance of the car backing off, or the walls may be made to slope slightly toward the front end.

With such a support always at hand, it is a simple matter to run the car up on to it for a hasty repair at any time, and the light and working facilities will be much better than they could be in a pit in the garage. The merely nominal outlay in money will be soon made up in repair bills saved, and will be a means of encouraging the boys to keep the car in condition. Ten or fifteen minutes once a month should be sufficient to go over the nuts which are apt to work loose.

Four or five dollars will buy the cement and sand for this support for your car.—Dale R. Van Horn.

A Cutter for Making Large Holes

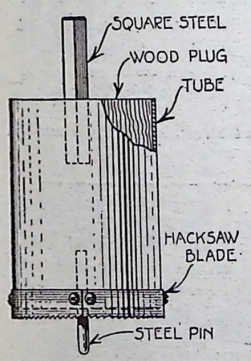
CUTTING large holes in sheet metal is sometimes quite a problem when the metal is too heavy to work with shears, or the hole is not large enough.

A highly satisfactory tool can be made for the purpose in the following way:

Take a piece of brass or steel tubing of a diameter about 1/16 in. smaller than the size of the hole. Plug one end with hard wood, carefully square up the plugged end, both wood and tube, accurately mark the center, and insert a steel pin about ¼ or 3/16 in. in diameter, letting it project about 1½ in.

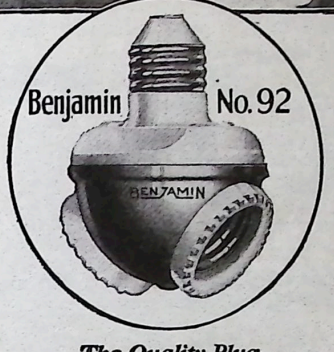
Have the pin tight in the wood and well supported.

Take a hacksaw blade with fine teeth and cut it to such a length that it will exactly encircle the tube, the ends coming close together. Secure the blade to the plugged end of the tube with small machine screws tapped into the tube, allowing a little more than half the width of the blade to project below the plugged end. Use at least five screws—one in each end of the piece of hacksaw blade and the other three at equidistant points; if the tool is large, use more screws. An important point is that it will be found necessary to draw part of the temper of the blade before it can be bent and drilled, but the softening process should not be carried any further than is necessary. Heat the blade on a piece of flat iron, or in an iron pipe, held over a Bunsen burner or other gas flame so the heating will be even. If the blade is too soft, the teeth will not last long; while if it is made too hard, it cannot be drilled and will break when an attempt is made to bend it.



A hacksaw made into a circle will cut any size hole

It will be necessary to do a little experimenting and to spoil a few blades before just the right result is obtained. To use the tool, drill a hole in the sheet metal for the steel pin, making the hole so that the pin will fit without lost motion; put the tool in an ordinary brace, insert the pin in the hole, and turn. The hole will be smooth, clean, and true. Not much pressure is required. A good way to attach the cutter to the brace is to plug the upper end of the tube in the same way as the lower end and insert a piece of square steel that will fit the chuck of the brace. Drill a hole somewhat smaller in diameter than the diagonal of the square steel and drive steel into place.



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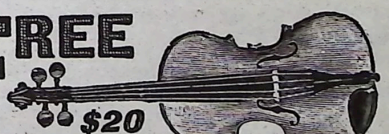

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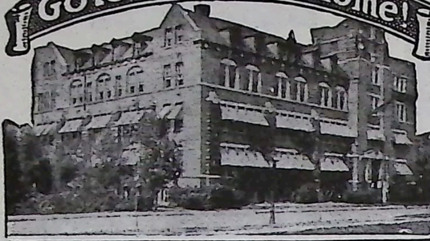

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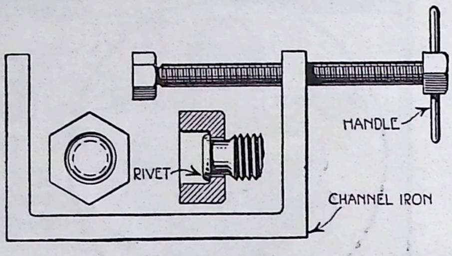
How to Make Your Own Cabinet Clamps

A CABINET-MAKER'S clamp suitable for the amateur's workbench can be made of a section of channel iron and a discarded bolt as follows:

Cut out a section of heavy channel iron about 1 in. wide. The width of the iron between sides should be enough to furnish jaws of sufficient opening for ordinary work.

Select a suitable steel bolt and drill and tap a hole near the top of



Channel iron and an old bolt will make an excellent cabinet clamp

one of the jaws of the clamp into which the bolt can be threaded. A second hole through the bolt-head should be drilled to take a short piece of rod for a turning handle.

File the end of the bolt smooth and round and about half its original diameter.

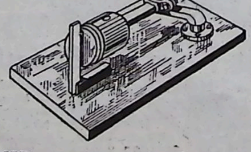
The bolt should then be set through a hole in a nut. One half of the nut is hollowed out and the end of the bolt then can be riveted over so the nut will revolve easily but will not allow the end of the bolt to project beyond it. Thus the bolt, when turned down on any article, will not mar it.

Such a clamp is cheap, simple to make, and will do the work required of it as well as the more expensive kind.

To Check Up the Alinement of a Connecting-Rod

A PART of an old discarded crankshaft used in conjunction with an old face-plate and square, is a reliable means of checking up the connecting-rod alinement of a motor vehicle.

The crankshaft must be cut just forward of the connecting-rod bearing, and the flywheel flange used as a base to bolt the dummy crank thus formed to the faceplate.



When your engine knocks, test the alinement of the connecting-rods and eliminate the trouble

The assembly to be tested is attached to the bearing, as shown in the illustration, and a metal square is used to determine whether or not the top of the engine piston is parallel to the crankshaft bearing. It will be seen that the

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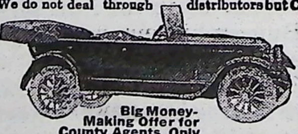

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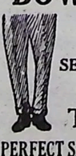

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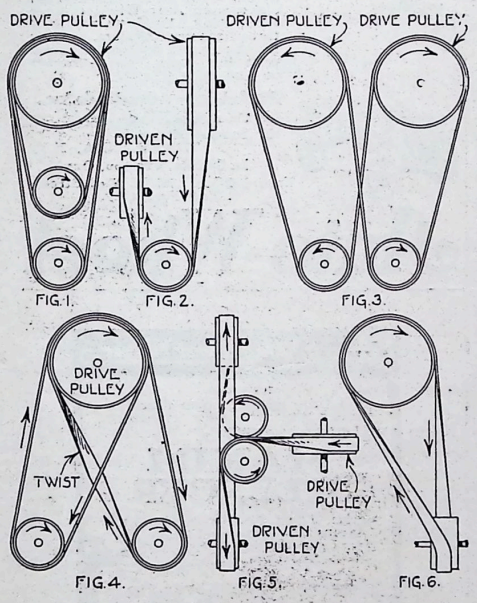
dummy crank must be bolted to the ace-plate absolutely true, otherwise the accuracy of the test will be destroyed.

When the engine continually knocks or scores the cylinder walls, while all other parts are apparently in normal adjustment, it is wise to check up the connecting-rod alinement as described.—RONALD L. PRINDLE.

Some Ways of Arranging Machine Belting

THE amateur machinist is not always aware that belting can be arranged to drive a wheel or countershaft in any other way than by the direct method employed in all ordinary power transmission. A man having his own little power plant in the basement, attic, or in any small, confined quarters, can, by clever manipulation of belting, greatly increase



Some suggestions for belt-drives that will prove invaluable to any one with limited shop space

the machine capacity of his limited space. The illustrations show how a few of these combinations can be made, and their advantages are obvious.

Figure 1 illustrates how two belts can be run from the same pulley to drive two shafts. In this case the middle shaft must be situated in line with the other two. While this is a favorite method with some machinists, it is little enough known among amateurs.

Figure 2 shows a flat belt transmitting power between two parallel shafts over guide pulleys, the shafts not being in the same plane. Such shafts may be located in any direction from each other with the arrangement of guide pulleys as shown.

Figure 3 shows a method of transmitting power by a flat belt from one shaft to another in a case where the shafts are too near together for direct driving. In this example the belt is also directed by guide pulleys.

Figure 4 illustrates another way of

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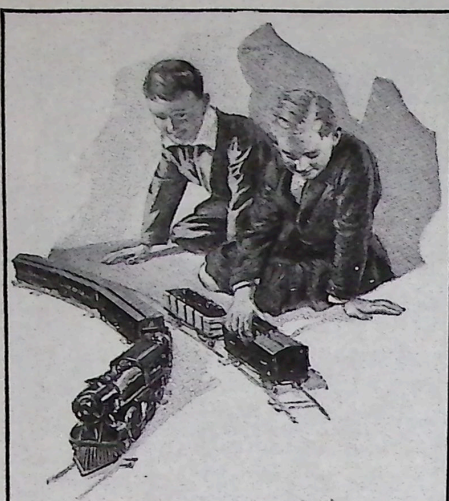

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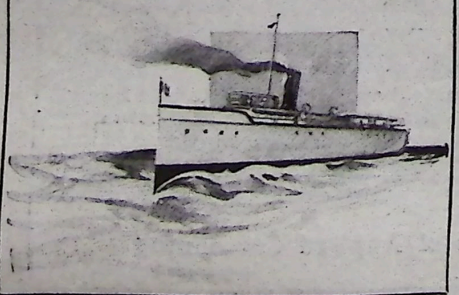


driving two shafts by belts from one drive pulley. In this method the drive is accomplished in the same manner as with an ordinary cross belt; that is, a twist is made in one belt where it crosses the other, thus eliminating interference.

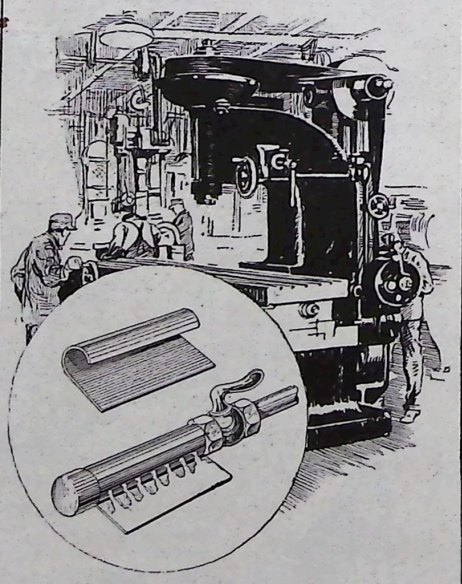
Figure 5 shows how one belt can be used to transmit power from a main shaft to two other shafts running at right angles to it. However, these must be all in the same plane.

Figure 6 shows the manner in which two pulleys should be belted up which are at right angles to each other, but *not* in the same plane. Certain conditions are necessary to make this connection right. In the first place, the distance between the near faces of the pulleys should not be less than four times the width of the belt. The pulleys should be so arranged that a line drawn from the center of the face of one pulley will be tangent to the face of the other. This idea is illustrated in the sketch. The deflection or twist must come from the pulley with the wider face.

These arrangements are invaluable to the man with limited shop space and who wishes to make the most of his source of power. Belts must, of course, be kept in good condition and well cared for to do the greatest amount of work.—L. B. ROBBINS.

A New Lubrication Idea for a Milling Cutter

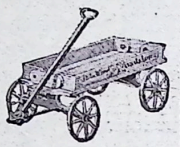
IT is a well known fact that if a milling cutter is well lubricated while it is cutting, it will perform quicker and better work. Acting on that assumption, here is what the writer did:

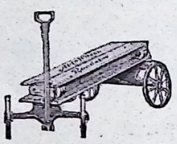


Instead of a thin stream of lubricant, this device throws a wide stream on the milling cutter

In place of the ordinary single pipe which fed the lubricant to the cutter, a long pipe was made with a series of holes in it similar to those in the illustration. Next, a piece of tin was bent to the shape shown and the result was a good wide stream of lubricant.—J. W. MOORE.

What the Spin Means





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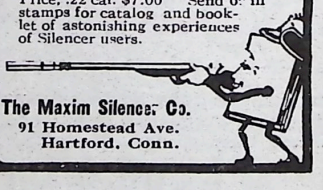

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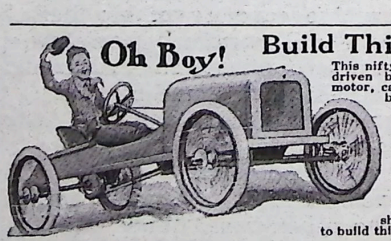

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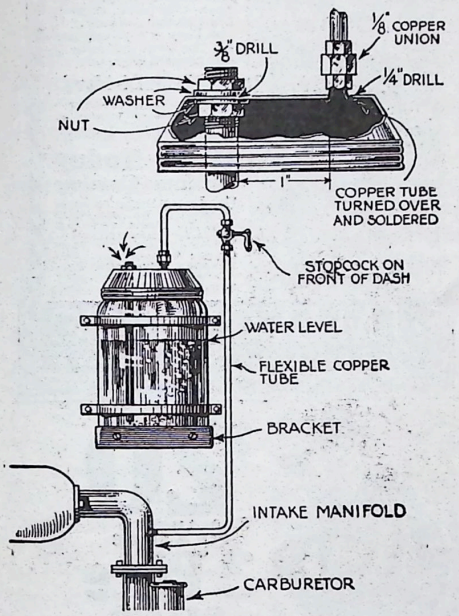
ALMOST every man who owns or has run an automobile has noticed that his engine actually runs better in the very early morning or late at night, just after the dew has fallen. This is due to the amount of moisture in the air.

Why contend with the frequent skipping of the engine and the loss of



Iron straps fasten the humidifier to the dash beneath the hood. A copper pipe runs from it to the carburetor

power due to the hot dry air of a summer day, when with a few hours' time and a little expense you can manufacture an apparatus which will give you the moist cold air that gives life to your engine?

A Mason preserving-jar of the quart size should be mounted on the back of the dash underneath the hood of the engine. This may be done by the use of an oil-can holder for a shelf and a couple of band iron straps to hold the glass jar in place. In the metal top, about 1 in. apart, drill two holes, one with a ¼-in. drill and one with a ⅜-in. drill.

Solder into the ¼-in. hole a small nipple having on its end a small union joint such as is used with flexible copper tubing.

A piece of ⅛-in. brass or iron pipe ½ in. shorter than the height of the jar, should be threaded on one end for about ⅜ in. On this thread place one nut and one washer and thread through the cover of the jar, placing another washer and nut on the outside, tightening the two nuts until the cover is held rigid, and when mounted on the jar allows the pipe to extend downward to within ½ in. from the bottom.

A ⅛-in. copper tubing extends from the nipple soldered in the jar-top through the dashboard to a stopcock, and continues on back through the dash, and is tapped into the intake manifold just above the carburetor.

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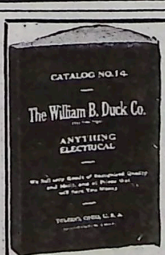

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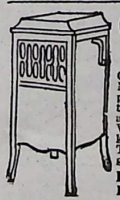

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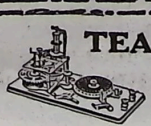

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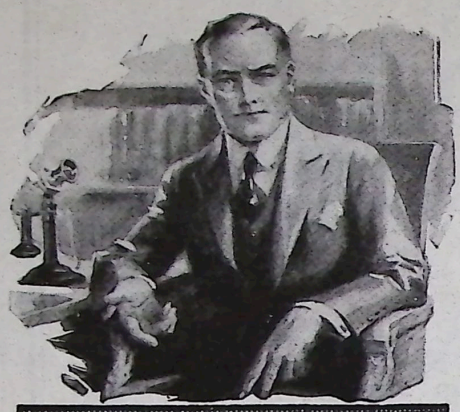

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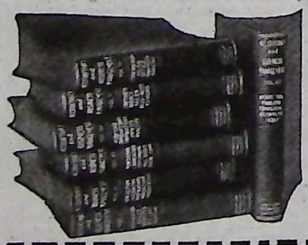

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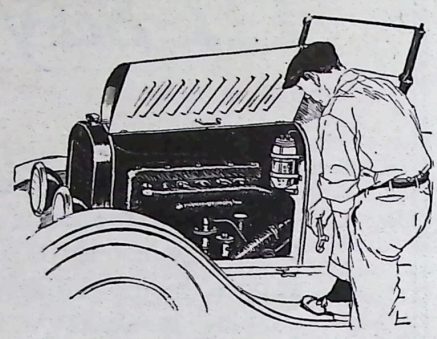
The jar is then filled to about three quarters of its height with water, by opening the stopcock so the air may escape, and pouring the water down the tube in the top.

When the engine is running, open the stopcock on the dash, which is within reach of the operator, and the



This shows the complete device as it appears when mounted.

engine will suck the air from the top of the water in the jar, this tending to cause a vacuum, and air will consequently enter the pipe and be delivered at the bottom of the water. As the air bubbles up through the water it is not only cooled but is saturated with moisture. This moist air passes into the intake manifold and gives the same result as if the car were being driven at night along the side of a river.

A bit of shellac applied with a tiny brush will help to make the joints airtight.

As the water evaporates, the jar may be again refilled by pouring water down the air inlet tube. No water will enter, however, unless the stopcock on the dash is open to allow the enclosed air to escape.

Using Stumpwood for Lime-Burning

FIREWOOD is becoming scarce and expensive. This has made the burning of lime more costly than in former years. It requires about 30 cords of wood to fire a kiln containing about 1500 bushels of lime.

Owing to the increased value of the wood, we see very few of the old lime-kilns in operation nowadays.

Coal has been tried as a fuel for lime-kilns, but the trouble with that is that it does not burn the kiln out clean. It leaves a great deal of unburned stone, which not only causes a loss, but makes a great deal of trouble for the operator.

One of the most prosperous and progressive farmers of Virginia hit upon the idea of using stumpwood for lime-burning. He had been clearing a lot of stumpland and the stumps had been hauled to a vacant lot, where it was intended to burn them. Before this action was taken, however, the idea of using the stumpwood to fire the lime-kilns occurred to him. His own farm needed liming badly, and he

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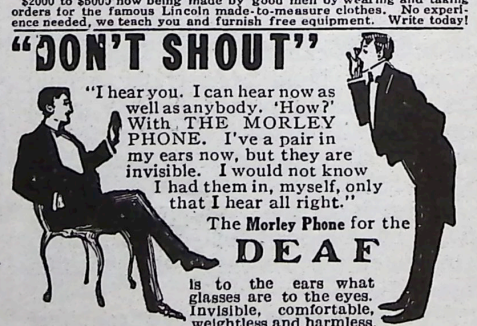

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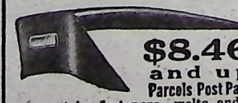

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had plenty of limestone available from which to make it. However, he hesitated about paying the price now charged for cordwood with which he might burn the limestone himself. He was inclined to think that he could buy the lime cheaper than the wood; that is, counting what it would cost him for labor to operate his kilns.

The pile of dry stumpwood solved his problem. The stumps had been nicely split up by the dynamite which had been used in blasting them out and made ideal firewood for the lime-kilns.

He estimates that the use of the stumpwood saved him about $45.00, and as much more would have been expended in hauling the cordwood.

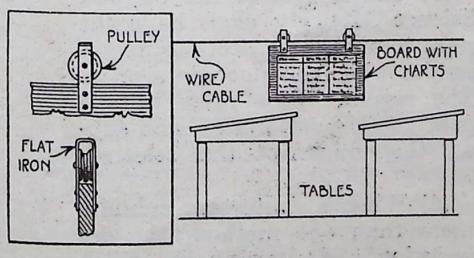
This man figures that in using the stumpwood to feed his kilns, he really got his land cleared and limed for less than nothing, because the value of the lime produced more than equaled what the clearing had cost him.

It is common practice for farmers to pile their stumpwood and burn it as soon as it is dry enough to burn after blasting. In view of the scarcity of wood, this is poor economy. Down here in our section of Virginia we are using stumps for firewood in our open grates and sheet-iron heaters. In sections where limestone exists and where lime is needed for the farms, it is decidedly poor economy to burn the stumpwood in the field, for it is most valuable for burning the lime.—CHARLES F. HIGGS.

Reference Tables Passed Along by a Trolley-Line

THIS idea, which illustrates how one drafting-room eliminates waste of time, is so adaptable to other lines as to merit attention.

In order to speed up the work of passing various reference tables from one draftsman to another, a trolley-wire was erected as shown in the illustration. This wire ran above the row of drafting-tables and a board attached to two trolley wheels which ran upon



Make a trolley-line for your office and send the work in a carrier

the wire. Pasted on the board were the reference tables. A draftsman requiring the tables would merely ask for the board and the man who had it at his desk would give it a push, and away it would go down the wire to the required desk. A simple idea yet a real time-saver and one which is adaptable to almost any office work.

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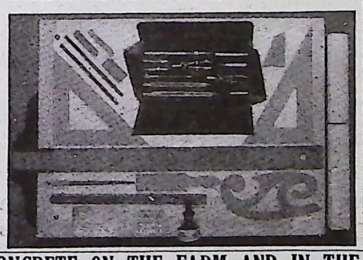

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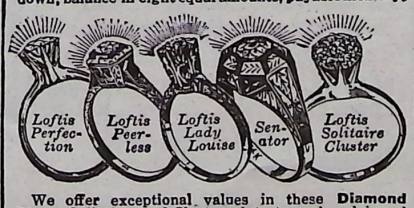

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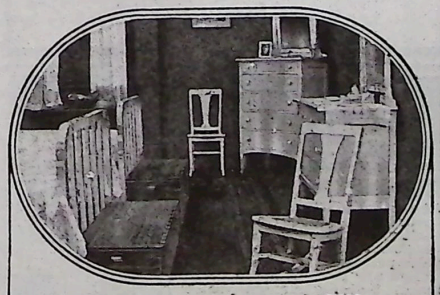

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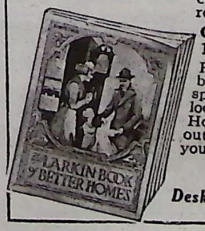

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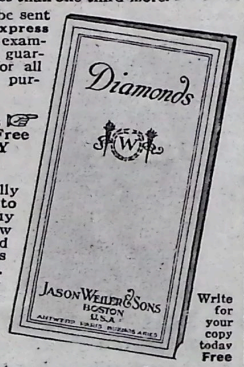

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Have You a Step-Saving House?

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HOW do you save steps in your home? What arrangements or what appliances have you made that save time and reduce work that would otherwise have to be done by hand?

The Popular Science Monthly wants to know just what practical and useful things can be constructed to make every house a step-saving house. For instance: a concealed laundry chute would interest us, if it weren't so old; a space-saving cupboard—another old one. No patented or marketed appliances will be considered.

The Popular Science Monthly offers three cash prizes—a first prize of $50, a second prize of $25, and a third prize of $15—to be awarded in accordance with the rules set forth below.

Rules Governing the Contest

(1) Contestants are not limited to the number of step-savers and time-savers, but only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The method must be shown clearly either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the writer's idea very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably typewritten, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the Popular Science Monthly not later than 5 p. m. on Friday, December 31, 1920.

(5) The judges of the contest will be the editors of the Popular Science Monthly.

(6) The first prize of $50 will be awarded to the contestant who, in the opinion of the judges, has suggested the best method for saving steps in the house.

The second prize of $25 will be paid to the contestant who submits a method next in merit.

The third prize of $15 will be paid to the contestant who submits the method third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of the Popular Science Monthly. A description of the methods which win the three prizes offered will duly appear in the pages of the Popular Science Monthly, together with the names of the winners.

(8) The editors of the Popular Science Monthly shall have the right to publish meritorious manuscripts which do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

(9) When a contestant submits more than one method, the description and drawing by which each is set forth must be sent as a separate unit.

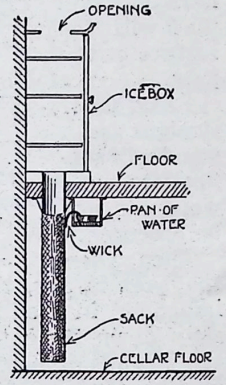
(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

(11) Send drawings and specifications to the Editor of the Step-Saving House, Popular Science Monthly, 225 West 39th Street, New York City.

Cooling the Shelves of the Kitchen Closet

A CURRENT of cool air can be made to circulate through the shelves of a kitchen closet by cutting holes at the top and bottom through the flooring and walls and by using "icebox" shelves made of perforated iron.

The air can be kept cooler and cleaner if a length of sheet-iron furnace pipe is run from the hole in the closet floor down into the cellar below, so that the open end of the pipe is but a few inches from the cellar floor.



Air circulating through the wet sack keeps the closet cold

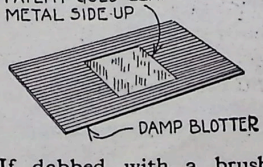
Then a cheesecloth sack is made to fit over the open bottom and sides of the pipe and is hooked to the ceiling near the top of the pipe. A shelf to hold a pan of water is put up near the top of the sack. A wick, sewed to the sack and dipped in the pan, serves to keep the sack damp and the air within the closet several degrees cooler than it is outside.

The bottom of the sack over the open mouth of the pipe prevents particles of dust entering the closet. During the winter months a damper in the pipe will be found useful.

How to Apply Gold Leaf to Uneven Surfaces

WHILE patented gold leaf is the handiest to apply to flat, even surfaces, it is not so easy to use on depressed or uneven surfaces, especially if the depressions are of some little depth. Nevertheless it sometimes happens that it is the only kind on hand.

FIG.2



If dabbed with a brush the dampened gold leaf will sink into the depressions

I find the best method is the following:

Lay a damp — not wet—blotter on some flat surface. Place a sheet of the patent gold-leaf, metal side up, on it. Place a spent sheet on the metal and rub until the under side is evenly dampened. Remove the spent sheet and take up the dampened sheet of gold. It won't tear. Place it against the surface to be gilded and dab with a bristle brush so as to drive the gold into the depressions.

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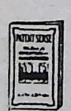

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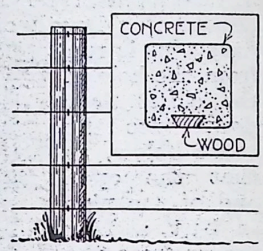
A Simple Wood Insert for Cement Fence-Posts

MOST of the difficulty with cement fence-posts comes in supplying a suitable method of tacking the wires to them. This is easily overcome by the method described.

A strip of wood, wider on one side than the other, is embedded in each concrete post, in the casting, with the narrower side flush with the surface of the post.



How wire can be nailed to a wood strip inserted in concrete

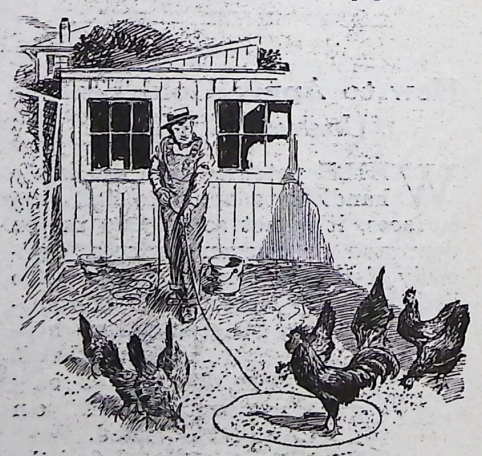
Lengths of straight green wood will sufficeif seasoned wood can not be procured.

Then, when the post is dry, this wood is solidly imbedded in it and presents a narrow strip down the entire length to which the strands of fencing may be tacked or otherwise attached.

Get Your Chicken Dinner with a Lasso

OF course Miss Chicken may object to being roped in, as it were, but by using a lasso you are absolutely sure of having her for dinner.

Scatter the corn as you always do when feeding the chickens, placing a cord lasso in a loop about it. Have plenty of slack to the end of the twine



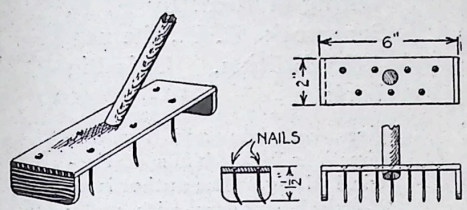
Corn is scattered inside the cord loop. As soon as the chicken gets inside, the loop is pulled tight and your dinner is ready to cook

so as to stand back far enough in order not to frighten the fowl that you have your eye upon. When the bird walks into the loop, pull upward quickly until the loop tightens about her leg. Several of her friends may come in with her, but you can release the ones you don't want.

If the rooster, as in the illustration, tries to "corner" the grain-supply, patience must be used to lure him away.

Picking Up Threads Is No Easy Task

THE thread-picker as shown in the illustration was found to be very useful in picking thread or hair from the floor. If this is done before you use your vacuum cleaner or carpet-sweeper, it will prevent the brushes



Why not a thread-picker as well as a carpet-sweeper? It is easily made and will save you from bending over

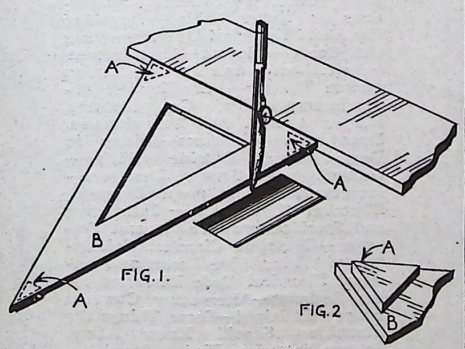
from becoming entangled with the thread or hair.

One will find this picker a very simple device to assemble. It can be made from a few pieces of wood procured from an old soap-box, some 1⅞-in. brads, and an old broom-handle.

Be sure that the side guides are longer than your brads when bent, in order that the brads will not stick into the rug, as the side guides are only to act as runners for the picker to ride on and to enable one to keep the brads in the proper length.—H. E. MENDE.

Something to Know about Line-Shading

IN heavy line-shading—as in a Patent Office drawing—there is a tendency for the ink to flow under the triangle and cause a blot. The accom-

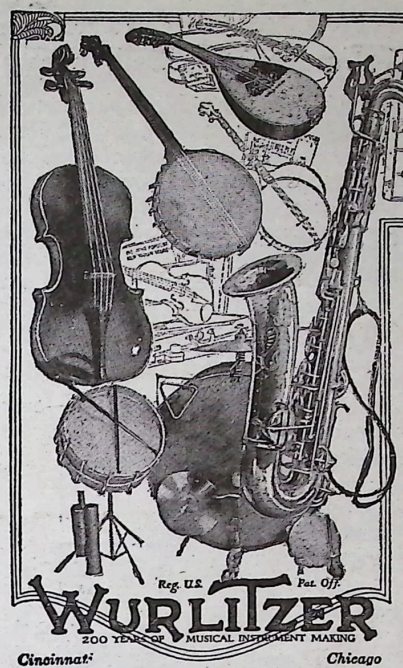


Your triangle won't blot, even over heavy ink lines, if you raise it from the paper by cementing lugs on each corner

panying illustration shows a device useful in such cases.

On the triangle *B* (Fig. 1) small triangular lugs are cemented on each corner. These should be placed slightly back from the edge as shown (Fig. 2). The triangle is thus held clear of the paper and may be used even over fresh ink. The triangle *B* should be fairly thick. The pieces *A* may be cut from an old triangle.

If the triangle is made of hard rubber or celluloid, it is best to make the lugs of the same material, using rubber cement for fastening them.



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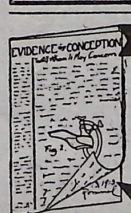

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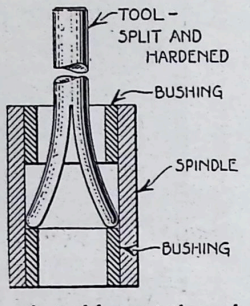
A Tool for Removing Spindle Bushings

PARTS of machines such as spindle bushings are often difficult to drive out. With a tool like the one herein described, however, the job becomes much easier.

Get a piece of round tool steel a trifle smaller than the spindle's inside diameter. Soften the bar and saw up through the middle for about half its length. This makes it appear something like a large cotter-pin.



A steel bar cut through the middle removes spindle bushings

Smooth down nicely and reharden after the tines are spread somewhat as shown.

The tool is inserted, handle first, through the exposed end of the bushing and pulled through until the tines spring out and rest on the inside face of the bushing.

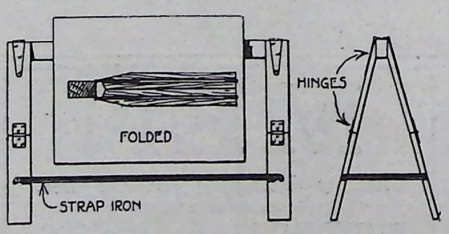
Then the top of the handle is tapped with a soft hammer until the bushing is started.

By providing oneself with several sizes of these tools, practically any size bushing of similar character can be handled by the machinist.

Making a Trestle that Can Be Folded Easily

A COLLAPSIBLE trestle is easily constructed and can be conveniently stored when not in use, or easily transferred from place to place, as occasion may require.

It can be made from as heavy material as the work requires. The legs, instead of being nailed permanently to the heavy timber used to hold them together, are attached by hinges.



This compact collapsible trestle can be stored and easily moved about by the workman

The legs may also be spliced by gate-hinges. They are then locked by pieces of strap iron, having notches cut in them, which drop over projecting nails, preventing the legs spreading. The ends and sides are both supplied in this manner.

When a shorter trestle is desired, these braces are removed, allowing the legs to unfold at the hinge and rest at this joint, while they are secured by the braces above in a similar manner as before.—C. C. WAGNER.

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Electric-Light Bulbs Make Good Clothes-Sprinklers

MANY women sprinkle their clothes by hand, and many more go to the trouble of purchasing a clothes-sprinkler when they could easily make one at home. Here is a way of making your own clothes-sprinkler that will do the work as efficiently as any factory-made article.

Procure a blown-out electric-light bulb, one with the inside wires broken (if the glass itself is broken, the bulb will not do), and immerse the bulb in a basin of water. File or break off the tip of it. As the file eats through the glass the water will rush into the

By breaking the tip from an old electric-light bulb in water it can be used successfully as a clothes-sprinkler

bulb, and upon taking it out of the basin the water will stay inside until a shake releases it.—A. GOLDENBAUM.

Did the Telephone Company Know About It?

HAVING occasion to use my telephone downstairs during the day and upstairs during the night, but believing the convenience thereby obtained did not warrant the rental required by the telephone company to install and maintain a second instrument, I purchased two telephone jacks and a plug. The telephone-box containing the coils and the bell was already in a convenient location and the bell could be heard distinctly all over the house.

On the end of the cord of the telephone-desk stand, which was normally connected with the telephone-box, I placed the plug. A three-wire strand was connected with the terminals of the box and run to both jacks. One jack was located in a convenient place downstairs and the other upstairs. Disconnecting the telephone instrument from either jack does not interfere with the ringing of the bell.

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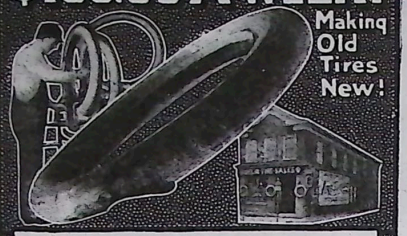

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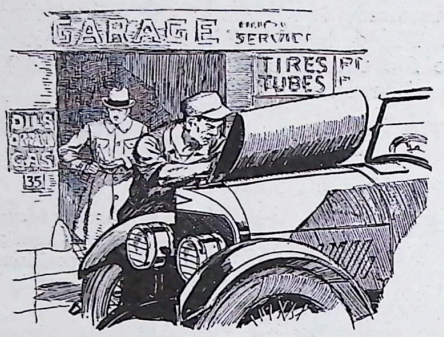
Some Ways to Avoid the Repairman

COMPARATIVELY few owners and drivers of automobiles are aware of the value of soap for sealing leaky joints in the gasoline system. Very frequently gasoline oozes out around the filler cap, especially when the tank is nearly full. Such a leak is objectionable because the gasoline spreads over the outside of the tank, which nowadays is usually carried at the rear of the car, collects dust and impairs the finish. A coating of ordinary soap on the gasket and threads will prevent leakage, even when the tank is full.

Many automobiles have no provision aside from a strainer in the tank for keeping dirt from the carburetor. Owners of such vehicles will do well to fit a trap in the fuel line. All the big carburetor makers offer these traps, which are to be placed in the line near the carburetor or in the bottom of the tank. The trap catches all the dirt and water and should be cleaned out regularly once a month.



Immediate attention given to unusual engine noises will keep your automobile away from the repairman

In taking battery readings with the hydrometer the operation should be performed before the distilled water is added to the solution, which will otherwise be diluted and a wrong reading given. Also, after the water has been put in, it takes some time to mix with the acid. The water, being lighter, stays on top, and if the hydrometer is used, say an hour after the water has been added, it will wrongly indicate a weak solution.

It is common to find automobile frames that sag in the middle after a considerable period of service. Sometimes this condition produces difficulty in clutch-shifting and other mechanical operations because the various parts have been twisted a little out of alinement. The proper way to cure a sagging frame is to fit a truss-rod with a turnbuckle under the sagging portion of the frame. If the owner cannot carry out the repair himself, any machinery shop or garage can do the work.

If dash and tail lamps are in series, the failure of the dash lamp puts the tail light out of commission. Very often a makeshift repair can be made in the following manner: Smash the burned-out lamp-bulb so as to gain access to the inside of the lamp. You will see protruding from the glass stem two so-called "leading-in" wires. By twisting these leading-in wires together and putting the lamp base back into the socket, you again establish an unbroken path for the current and your tail light, at least, will burn. If the tail light should give out, shift the dash lamp to the rear and put the twisted-together base of the burned-out tail light to the socket of the dash light. Needless to say, this wire-twisting stunt works also in the case of a burned-out or injured head lamp, provided they are in series; in this case you have at least one head lamp to proceed with.

It must be borne in mind, however, that when a single series-connected lamp takes the full voltage of the system, it is apt to burn out if the storage battery carries a top-notch charge, or if the generator develops sudden bursts of excess current, as may happen when the motor is made to race in pulling out of a snowdrift or mudhole. But with reasonable care in driving, the single lamp, together with the twisted-together remnant of the broken bulb, will do emergency service until a new lamp can be secured.

Tire repairing on the road is never a pleasant pastime, and we are not likely to exercise much care about details, especially when they seem unessential. There is one small thing often overlooked which has much effect later.

If the tube is allowed to get into the dust, and particles of sand or grit stick to it, or if these find their way into the case, more trouble is ahead. In time you will find your tube full of tiny holes as if fine glass had done the work. The inner tubes should never be allowed to touch the ground, and before they are put in place they should be carefully cleansed of any grit which may adhere to them.

Conserve the tube. Watch the grit.

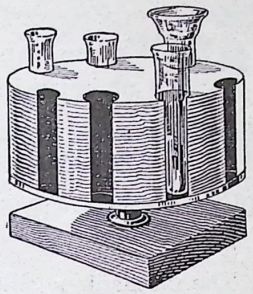
Air leaks are a common cause of misfiring, though they are often overlooked. A worn valve guide allows enough air to be sucked into the cylinder to cause misfiring, and it also permits oil to leak out. If oil is discovered leaking out, it is fair to assume that excess air is being injected into the fuel charges.

When a keyway becomes worn, the first thought of the owner is to file the channel larger and fit a larger key. To do this often weakens the metal seriously, and it may be found that a preferable way is to weld new metal into the old slot and then cut a new keyway to fit the old key.

In lubricating automobile springs, the greatest trouble is found in keeping the lubricant from being squeezed out under pressure. A compound that obviates this is found in graphite and beeswax mixed to a paste and spread upon each leaf. Obviously the spring must be taken apart to apply this lubricant.

A Handy Test-Tube Holder for the Laboratory

TEST tubes are frequently broken because they are left lying about the bench. Why not have a holder for them? That old discarded poker-chip holder so popular years ago can be utilized to good advantage for holding the extra test-tubes, as shown.



A poker-chip holder makes a handy test-tube rack

If necessary or advantageous, fit a round board to the bottom and attach a spindle to it which will revolve upon a base. Or else suspend the holder from the ceiling with a wire.

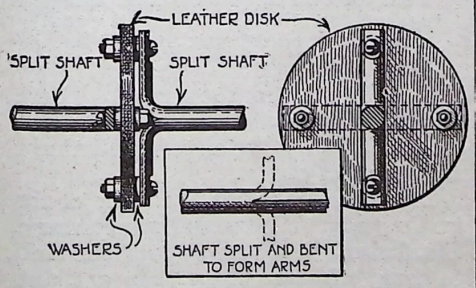
Such a holder will take care of several test-tubes of different diameters and prove a useful way of utilizing cast-off poker properties.

A Universal Joint to Be Used in Light Work

A SATISFACTORY universal joint for light work is made as shown in the accompanying illustration, and it has the advantage of running in absolute silence. It requires no lubrication, and will not wear, provided it is not overloaded.

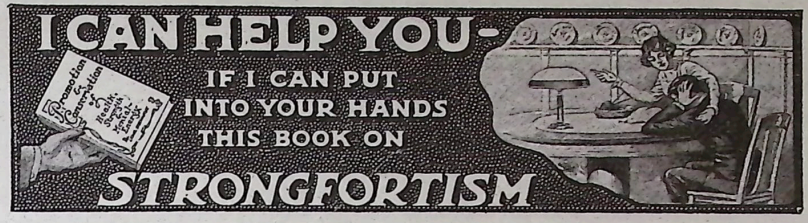
Split the ends of the shafts to be jointed, heat the split ends to a low red, and bend the two parts in opposite directions at right angles, being careful to have them exactly at right angles.

Drill the arms near the ends for small bolts, taking care not to make the holes so large as to unduly weaken the steel. Cut a piece of heavy leather into a disk and bolt the arms of the shafts to it, the arms of



This universal joint requires no lubrication and will run silently provided it is not overloaded

one shaft being at right angles to those of the other. It is necessary to exercise a good deal of care in getting the shafts exactly in line; otherwise the joint will wabble when it runs, and there will be pressure on the bearings and vibration if the speed is high. Perhaps the best way to do this is to bring up temporary bearings of wood blocks drilled a snug fit for the shafts, line them up with a solid shaft, and then put the two shafts to be



ARE you one of those languid, tired out fellows disinclined to go out into the world and make a fight for a place for yourself and family? Are you a croaker and a grouchy, grumpy clod whom nobody wants around?

Are You To Blame?

No one should be blamed for being dumpy, grouchy, disheartened if he feels all off when he rises in the morning and feels languid and sluggish all day; but anyone should be blamed who permits such a condition of the body and mind to ruin his whole life and the lives of those about him without making an effort to throw off disease and ill-health —when I stand ready to help him—when I offer to place within his grasp a system of self-cure, of rehabilitation, upbuilding and strengthening, that is leading the way in making better men, happier men out of thousands who had counted themselves failures.

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..Thinness	..Indigestion	..Lung Troubles
..Rupture	..Nervousness	..Weight Lifting
..Lumbago	..Poor Memory	..Muscular
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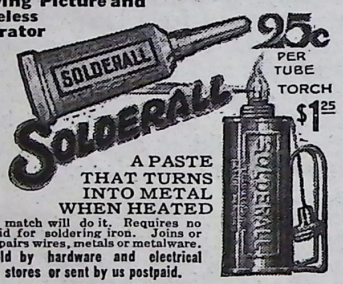

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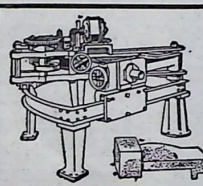

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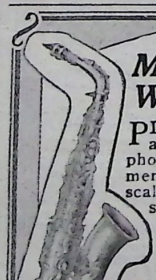

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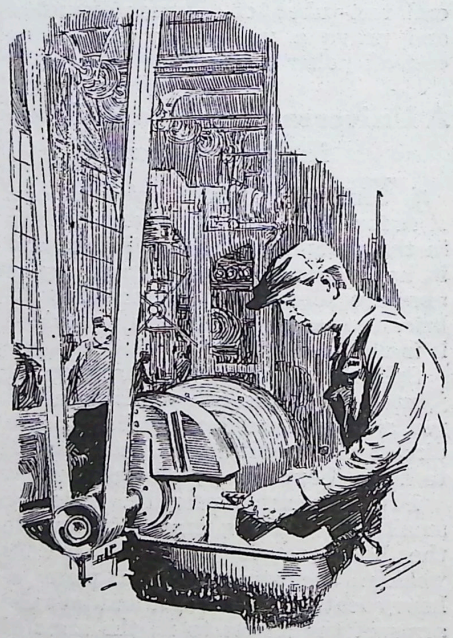
jointed into the temporary bearings to mark the places for the holes in the leather disk.

Put a good large washer on each side of the leather before screwing down the nuts. Rivets may be used if desired, and they are just as good if it is not necessary to take the joint apart.—HOWARD GREENE.

Do You Know the Proper Way to Sharpen Drills?

IT is surprising to learn of the small number of mechanics who can boast of knowing how to sharpen a drill. To those who would like to learn the proper method of grinding we offer this advice:

The mechanic should bear in mind the following factors: That both cutting lips of the drill must have the same angle to the axis; otherwise the cutting will be done on one lip and



Hold the drill to be sharpened lightly against the grinding wheel and watch it carefully to see that it does not burn

the drill will bore oversize. Both cutting-lips should be of the same length. If they are not, it will throw the point off center.

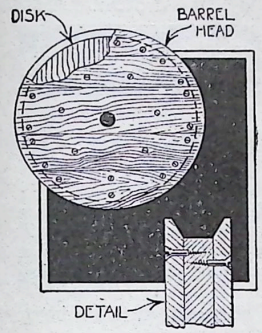
Proper clearance at the back of the cutting edge is absolutely necessary. Insufficient clearance causes the drill to drag, cut hard, and then get dull very soon. The angle of the lips should be sixty degrees for best results.

Begin by holding the drill lightly against the cutting wheel, with the cutting lip on the wheel. The wheels for use in drill grinding should be fairly soft and open so that they will not clog or burn. The drill must be lightly pressed against the wheel and carefully watched to see that it is not burned and the temper drawn. Twist the drill and at the same time throw the hand down in order to grind the clearance.—RONALD L. PRINDLE.

Making a Grooved Pulley from Barrel-Heads

OFTENTIMES a grooved wheel of fairly large diameter is wanted for temporary or rough use. Such a pulley, built of wood, can be constructed of two barrel-heads and a third wooden disk with a flat edge.

Cut the disk out of stock, the thickness of which is as wide or wider than the belt to be used. Its diameter should be the same as the smallest diameter of the barrel-head at the bottom of the bevel.



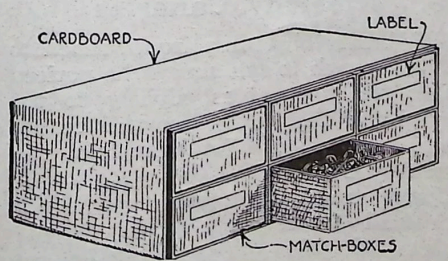
Temporary grooved wheels or pulleys made from barrel-heads

Screw the sections of each barrel-head to each side of the disk so they will be concentric with each other, and bore a shaft-hole through the center. Setting the grain of each barrel-head at right angles to that of the other will prevent warping.

A Portable Cabinet Made from Match-Boxes

TAKE six empty match-boxes. Glue them together as shown in the illustration and glue stout wrapping-paper around the whole. You now have a cabinet with six drawers that will fit comfortably in the coat pocket.

Further improvements can be added in the way of index labels pasted on the front of the drawers and little knobs for pulling them out. The cabinet may be strengthened by winding strong thread or pasting thin cardboard around the outside before the wrapping-paper is glued on. The cabinet may be increased in size, or it may be altered to fit some particular pigeonhole in the desk or tool-chest.



This little machine-part filing cabinet was made of six match-boxes bound with wrapping-paper

It is used by the carpenter to keep assorted sizes of brads and screws; by the machinist to keep small sizes of nuts, bolts, cotter-pins, etc.; by the watchmaker for small parts; in fact, the extent of its use is limited only by the number of trades that use different sized parts which should be kept separated.—MYRON DRACHMAN.

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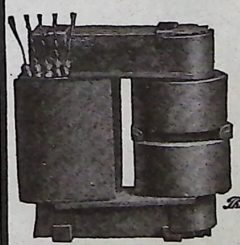

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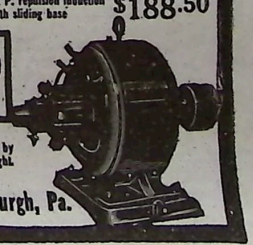

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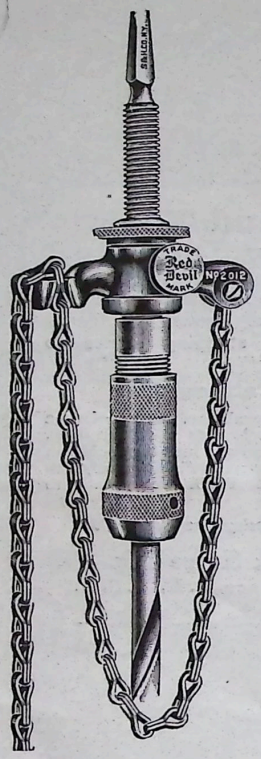

AN excellent drill for metal work. The Red Devil Chain Drill drills engine cylinders, sheet steel, steel beams, wagon tires, safes, boilers, pipes, flanges, etc. Can be used as a clamp. Works with a bit-brace, hand-drill, breast-drill, or even a wrench.

It has a hardened steel ball race and is fitted with a nickel plated Universal Chuck which takes round or square shank drills from 3/16 to 3/8 inch.

Yoke finished in red enamel and equipped with a three foot polished steel chain, it looks to be and is a strictly high grade tool, fully up to the "Red Devil" standard.

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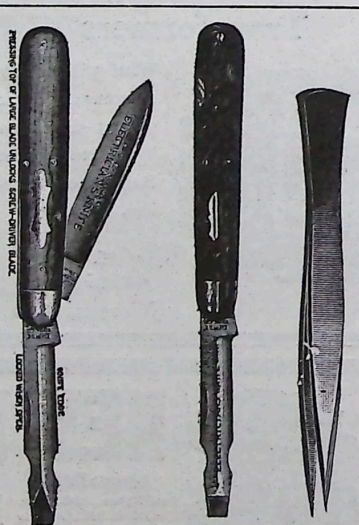

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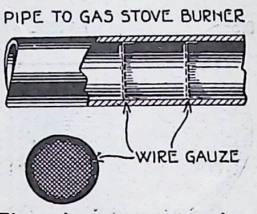
Taking the "Pop" Out of the Gas-Stove

NEARLY all gas-stoves will occasionally back-fire, or burn back in the opening where the gas is admitted, and some stoves have the habit so badly that it is a positive nuisance.

This can be cured, however, by inserting a piece of fine brass or copper wire gauze in the pipe leading to the burner—between tap and burner. Cut a disk of the gauze and bend up the edges, making a screen that will fit tightly in the pipe. If one screen is not enough, put in two, half an inch apart.



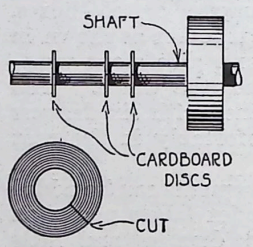
Fine wire gauze screening in the supply pipe will prevent the gas-stove from popping and back-firing

Automatic Shaft-Polishers Prevent Rust

SHAFTING in a machine-shop, which has been allowed to accumulate rust through neglect, can be kept in a clean condition by the use of the polishers shown in the sketch.

Cut out several disks of heavy cardboard, felt or leather, and slip them on the shaft by spreading a cut through one side. They should be fairly loose so the shaft will turn easily inside.

With the shaft in motion, these disks will travel back and forth along its length and in a short time will clean the steel of its rust and keep it bright.

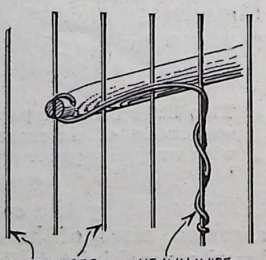


A set of these cardboard disks on machine shafts will automatically clean the rust from them

Springy Cage Perches Make Healthy Canaries

WHEN birds hop from branch to branch it can always be noticed that the twig gives slightly to the weight of the bird. For this reason bird-cages should be provided with springy sticks. These are attached to a piece of wire which firmly loops the stick.

The wire runs free for a short distance behind the twig before it is twisted tightly around a wire of the cage. In this case, as shown in the illustration, the stick must not rock from side to side.

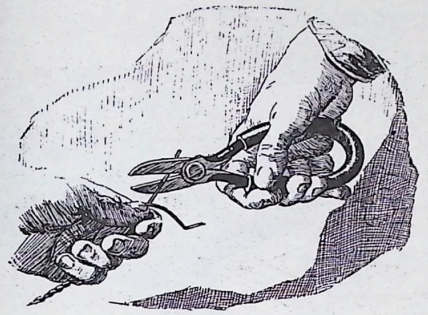


How to make a springy perch that simulates a branch

How Rubber Hose Improves Your Pliers

YOU can easily make all your pliers open automatically and stay open at all times by attaching a piece of rubber tubing or hose as shown in the illustration.

It is found to be very useful for instrument makers and electricians and at the same time it makes a soft handle



In order to keep the plier jaws open, use a piece of rubber tubing to clamp over the handles. It also acts as a non-conductor of electricity

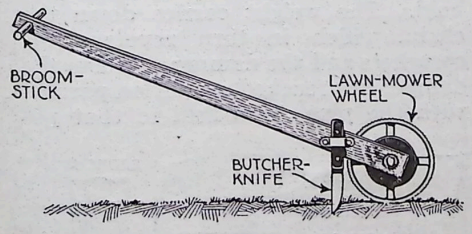
and a non-conductive one where live wires are to be cut.

It is much better than the metal spring which is attached to some pliers, as this gets caught in everything and is always in the way.

To Keep Flower-Beds and Lawns Trimmed

SOME little time is required to edge and trim walks and flower-beds even if the person doing it is experienced.

A gardener who had charge of a public park equipped his men with edging tools which he made himself.



This little tool will help speed up your lawn work and keep the edges neat

Wheels were procured from worn-out lawn-mowers, a hardwood stick four feet long, and a blade from an old carving-knife.

The illustration shows how the trimmers were made. With this tool it is a simple matter to trim or edge a good many flower-beds in a very short time, as the tool is operated after the fashion of a garden hoe, and the operator was able to walk along at a steady gait.

In some instances it was found better to bend the bottom edge of the blades at right angles to cut the grass roots and sever the sod.

"Some confab you had with the foreman. What was he telling you?"

"Only what I knew already. I was using my Vernier Depth Gage, and when he saw the Starrett mark on it, he started in telling me about Starrett Tools. How, when he was on the bench, he always used 'em, when he was doing real close work.

"It was nothing new to me. The first foreman I ever had—back when I was an apprentice—used to tell me the same thing. He'd been using them since the 80's. When I started to get a kit together, I bought Starrett Tools. Couldn't do without 'em. Simply have to have a Starrett for high-grade work."

"Sure. I never buy anything else either. And I always tell the kids in the shop to get Starrett Tools. Then they're certain to have a kit they can depend on."

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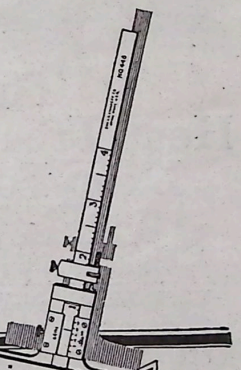

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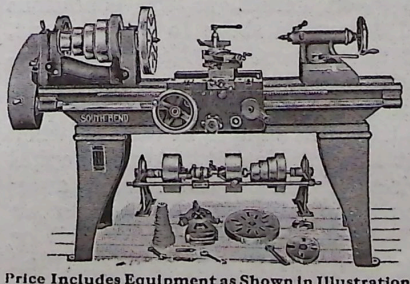

Price Includes Equipment as Shown in Illustration

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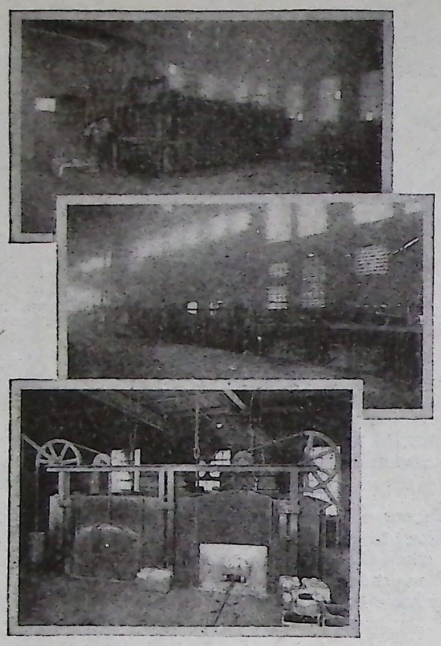

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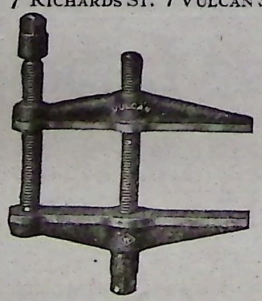


WILLIAMS' "VULCAN" MACHINISTS' CLAMPS

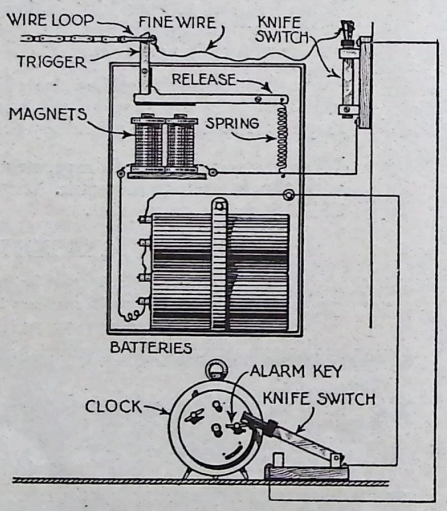
Ask for Clamp Book

Automatic Draft-Opener for the Furnace

By Thorton Hallett

WHEN the alarm goes off in the darkness of a cold morning, why not have the furnace drafts automatically opened so that by the time you have had a couple of extra naps and finally get dressed the fire will be burning briskly and heat coming into the rooms? With the aid of a few odds and ends found about any work-bench this can be accomplished, and part of the early morning labors abolished.

It will first be necessary to take out the turn-damper in the smoke-pipe and fit in a longer axle that will project at least 5 in. from the side of the pipe. To this axle is then fitted the large sprocket of a bicycle, and a wooden drum or spool over that, slightly smaller in diameter than the sprocket. As the drum is to be wound with cord, be sure and provide flanges each side so the turns will not run



Here is the electrical apparatus attached to the alarm-clock which actuates the furnace damper

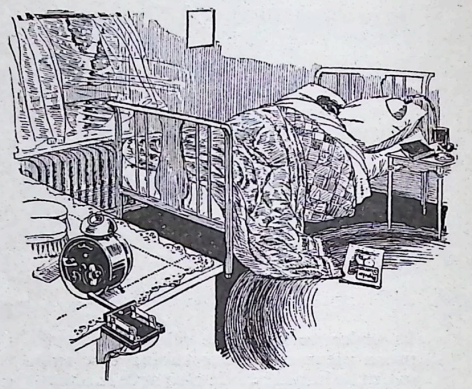
off. Also arrange the damper to turn easily in the pipe and not bind.

Next to construct is the electric release. This can be mounted upon a solid board nailed to the floor beams overhead and in line with the sprocket somewhat back of it as shown in diagram.

Then cut out the trigger and release pieces of sheet steel or iron and pivot them to the baseboard so they will work freely. No dimensions are given herein, as the conditions will determine those to some extent, but the proportions should be somewhat as indicated. Arrange the release so the little projection will hold the trigger in an upright position when that bears against it. A small spiral spring also holds the release away from the magnets. The magnets can be secured from an electric bell or telegraph instrument and mounted upon the base so the poles will come about $\frac{1}{8}$ in. lower than the height of the projection on the release.

Two dry batteries can be strapped to the base directly under the magnets and wired to them as shown.

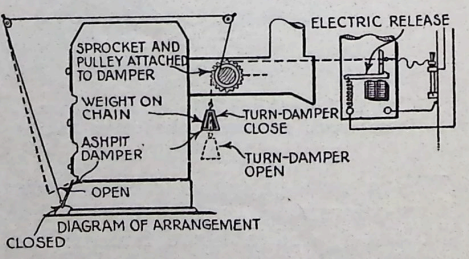
Next, just back of this electric release, and in line with it, set up a single knife switch and connect the handle of it to the loop on the end of a bicycle chain which runs over the

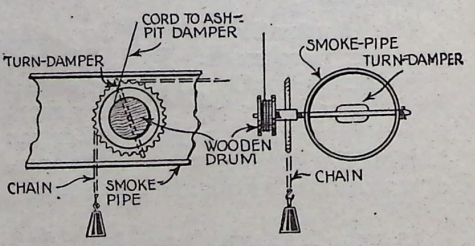


You won't have to start the furnace on a cold morning if you have this automatic draft-opener

sprocket on the damper-turner. The other end of the chain is provided with a weight.

The alarm-clock by which the damper arrangement is released can be situated anywhere in the house. Provide a second knife switch which works easily and fit it with an extra long handle. When the alarm unwinds, it lets the switch handle which was resting on it, drop into the poles of the switch below and this completes the circuit through the magnets on the release. The operation is simple. As the magnets are electrified, they draw the release down to them, which lets the weight on the chain pull the loop off the trigger and releases the hold. The weight carries down the chain, which in turn revolves the sprockets and the damper. When the damper has reached a position parallel with the pipe, it is held in that po-





The sprocket wheel and weight which turn the furnace damper are here illustrated in detail

sition by the cord attached to the chain and the knife switch back of the release. The pull on the cord opens the switch and breaks the circuit through the magnets, thus saving the power of the batteries. The length of the cord and the handle of the knife switch should be such as to determine just where the chain is to be stopped so as to bring the damper in the right position.

The ashpit damper can also be opened at the same time by leading a stout cord wound about the wooden drum and leading it over the heater to a pulley a little forward of the pit door as shown. When the sprocket revolves, it will wind up the cord and lift the damper.

The particular make and operation of the heater you are using will determine the exact position of the separate parts, but by a little figuring they can be arranged to operate the dampers as described.

Suggestions for Economy on the Automobile

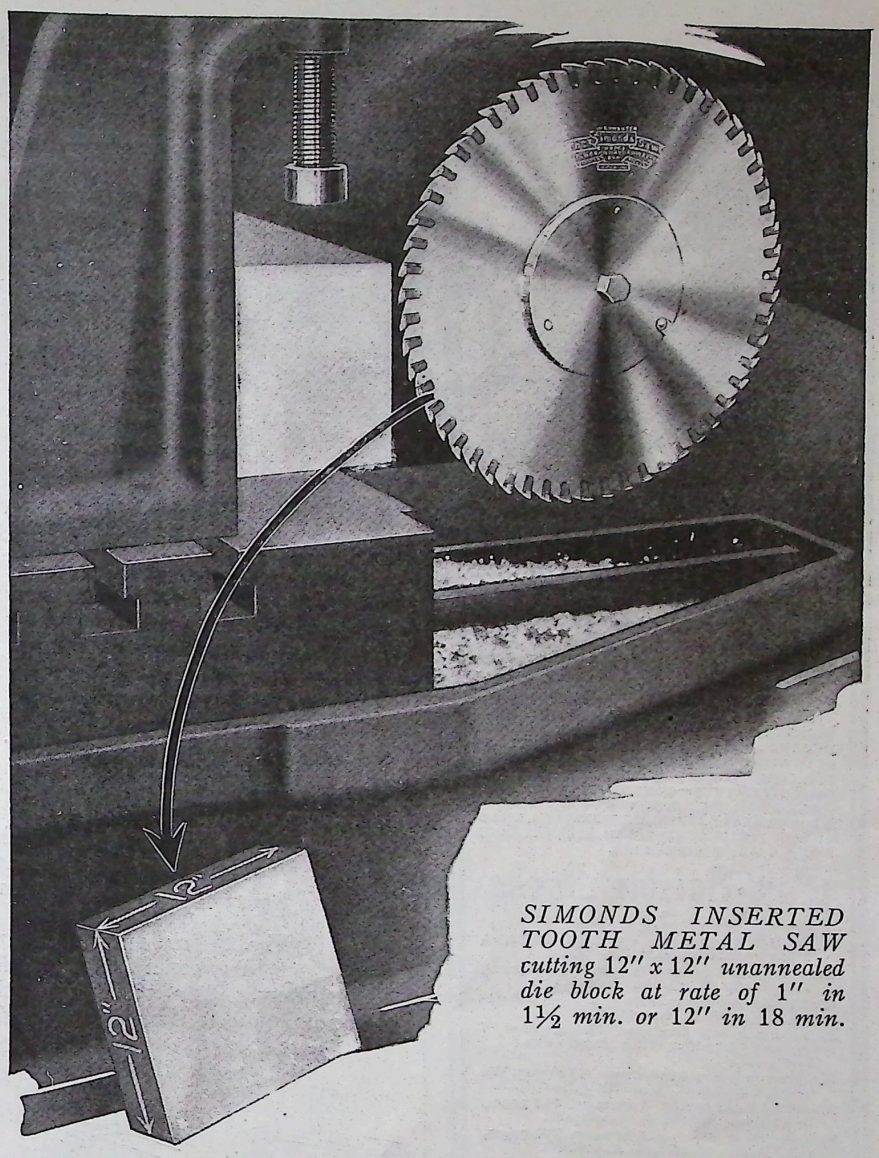
WHEN the brakes squeak it is usually due to dirt forced into the lining fabric when pressed against the drum. Often this dirt can be washed out with kerosene.

When the lining is thoroughly impregnated with dirt, however, kerosene will not prove adequate. In these cases, a small amount of rosin and castor-oil mixed as a fluid and applied to the brake-bands will put an end to the noise.

A crack in a cast-iron pipe or a cylinder jacket can be repaired in the following manner, without a great deal of trouble, if the pressure the part has to withstand is not too great: Dissolve some sulphate of copper in water, and after cleaning the edges of the crack well with a file or sandpaper, paint these edges with the sulphate solution several times until there is a coat of copper on them. The crack can now be filled with soft solder, which will adhere to the coppered edges.

There is a good chance of the curtains mildewing if folded and packed away when they are damp. It takes but a few minutes longer to dry them thoroughly before stowing them away, and the assurance of their keeping in good condition is worth these extra minutes.

As an amplification of the hairpin idea, every automobilist's tool-kit should include a spool or roll of small-diameter soft iron wire. This has a multitude of uses in and about an automobile. You know how handy the little wire hairpin is when something goes wrong on the road that only a piece of wire will fix temporarily. But very often this famous pin is not long enough. Better to have the spool of wire and never use it than to get stalled when a length of pliable wire would prevent it.



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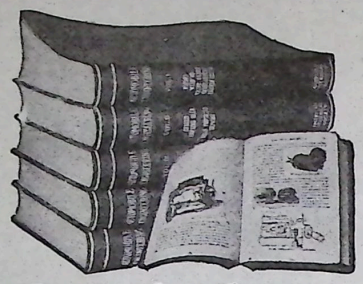

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An Easily Installed Burglar Alarm for the Home

By Mortimer V. Tessier

IN these days, when our daily papers are so full of the activities of the house-breaker, many will be interested, no doubt, in anything that will insure their home against a visitor of this kind.

Nothing will drive a burglar away quicker than an unusual noise of any kind while he is at work. For this reason the contrivance here described should be of special interest, for it can be wired into the line of your front-door bell and the moment Mr. House-breaker attempts to open a door or window, your front-door bell will start ringing and continue to ring until the door or window is again closed.

It can be installed easily without the aid of an experienced electrician and all you will require is a sufficient quantity of small cotton-wound wire, a cheap, single-pole throw-off switch, some sheet brass (not very thick), and a quantity of small wire staples to run the wires with. Also two dry-battery cells for the burglar alarm.

How to Install the Alarm

Cut from the sheet brass, which should be about the thickness of heavy tin, so that it may be easily cut and shaped with the shears, one spring, as shown in Fig. 2, for each door and two springs, as shown in Fig. 1, for each window. The springs for the windows should be turned in opposite

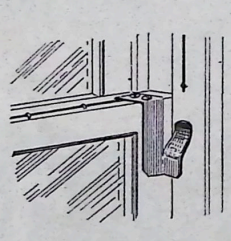


FIG. 1

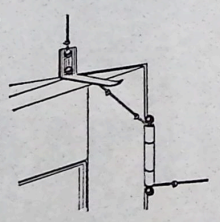


FIG. 2

The details of the general wiring plan for the homemade burglar-alarm system

directions, as they are to be placed on opposite sides on the top of the lower sash, as shown in Fig. 1.

After you have made enough of these springs to equip all the windows and doors on the ground floor of your home, you are ready to begin the installation of the line. The wire used for this contrivance should be small, single strand, cotton-covered copper wire. If it is covered with some material that will match the paper or woodwork, the wires will be much less conspicuous and can be placed so that very little can be seen of them.

Figure 3 will give a plan for the wiring of the alarm. If the two wires required in the line are placed along the top of the baseboard and a loop brought up at each window or door along the outside of the casing and brought down on the other side to the main line, drawn tight, and held in place by the use of the staples, they will be practically unseen except where they cross the wall from the baseboard to the window-casing. The wiring for the windows is as follows:

Place one of the springs for the window (Fig. 2) on each side of the top of the lower sash, and connect

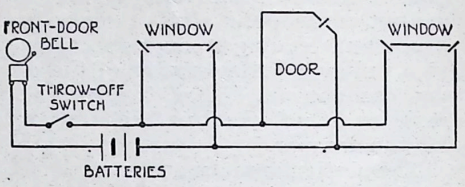


FIG. 3

The circuit is made or broken by means of springs when the door or window is opened

the two springs with a wire running along the top of the sash by winding the bared end of the wire once around one of the wire nails with which you fasten the spring in place.

These springs should be so placed that they bear lightly on the face of the sash strips at the sides.

Run a length of the bared wire down the face of the sash strip to within about half an inch of the top of the lower sash, taking care that it is in the track of the spring, which will slide up and down the sash strip as the sash is raised or lowered. Fasten this wire down with staples at intervals and turn the end of the wire into the wood at the lower end. Now carry the upper ends of these wires out over the casing at the top of the window and down along the outer edge to the baseboard, using the staples at intervals.

Care should be taken that you do not connect both of these wires to a single wire at the baseboard. Each should connect to a separate wire on the main line.

The doors are wired in the same way as the windows, using the spring shown in Fig. 2 in the manner described. The main-line wires may be carried all around the casing of the door and the connection made across the corner as shown, placing the spring so that it will bear lightly on the top edge of the door when it is opened.

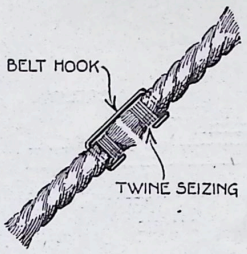
Fasten the bare end of a short length of wire over the edge of the door in such a position that when the door is opened it will connect with the spring. Bring this wire across the corner of the door and to the hinge. Lift the upper screw of the hinge out a couple of turns and wind the bare end of the wire once around, and drive home again. Repeat this operation with the other side of the hinge on the door-casing, using another short-length wire, and, carrying it over the casing, connect with the other wire in the main line. Repeat this programme with all the doors and windows on the ground floor, and finish by hooking in the dry cells and

connecting it with the front-door bell, breaking the line at some easily accessible place, and install the throw-off switch. This is very necessary for use in the daytime, so that then you may throw off the alarm completely.

To Splice a Clothesline Strongly and Easily

WHEN several sections of a clothesline have to be connected, or when a broken section has to be repaired, here is a simple way to do it that will prove strong:

Cut off the end of the line clean and bind each one with several turns of tightly wound twine. Then punch a hole through the center of the line about ¾ in. from the end and drive a steel belt-hook through these two holes, connecting the ends of the lines. By pinching the legs of the hook over on the under side of the line a solid repair is made.

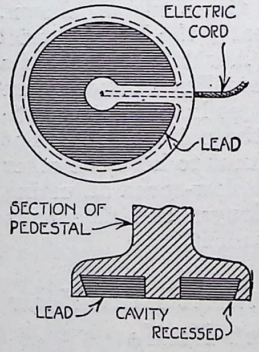


A steel belt-hook will hold the broken line securely

Lines can be quickly disconnected by twisting one at right angles to the other and pulling the hook out.

To Balance Ornaments that Are Top-Heavy

WE are constantly upsetting top-heavy ornaments, lamps, pedestals, etc. A great many of these accidents can be remedied easily, if the bases on which these lamps or ornaments rest are made heavier. This may be done in many different ways and does not require exceptional skill.



Balance top-heavy ornaments by inserting melted lead

The method of weighting such ornaments depends, of course, on the material of which they are made. If made of wood, bore holes in the base from the bottom, and with a chisel cut out the wood between the holes so as to join them.

At intervals cut three or four shoulders for locking. With lead melted just enough to run freely, fill the excavation. Be sure the base is level (upside down) and guard against the lead being too hot, as it will burn the wood. It is better not to fill to the top with the melted lead; and if there are any high places after it is set, use a cold chisel or file to reduce them. It is best to cover the base by gluing on felt to prevent scratching.

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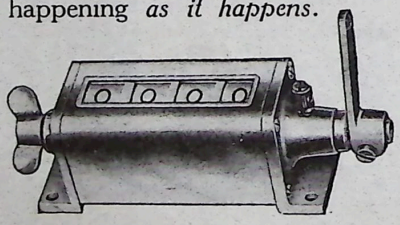
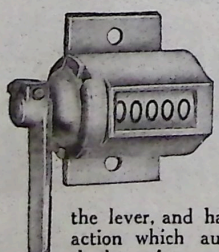
COUNTER

are the *results* of your management of your machine; the record is made as the machine runs—showing you what is happening *as it happens.*



The above Revolution Set-Back Counter records the output of any machine where a shaft-revolution indicates an operation. Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $10.00—subject to discount. *Cut less than ½ size.*



The Number 14 **Ratchet Counter** at left registers one for each throw of the lever, recording number of machine-operations. Supplied with outside stops which regulate the throw of the lever, and having return spring action which automatically returns the lever into position for the next count. The lever is adjustable, allowing the counter to be used at any angle. Price, $2.25. *Cut nearly full size.*

Most any machine you're interested in can be equipped with a Veeder Counter; write for booklet illustrating complete line.

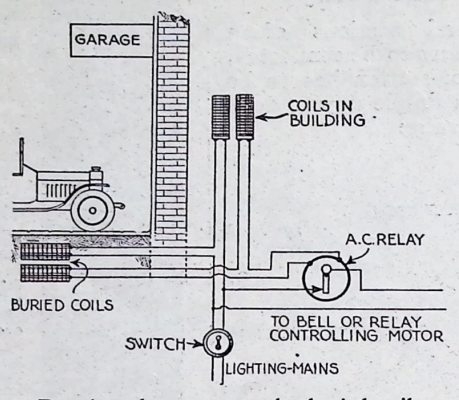
The Veeder Mfg. Co.,
44 Sargeant St., Hartford, Conn.

A Simple Automatic Signal for Garages

By Thomas W. Benson

RESIDENTS near public garages are often annoyed by motorists blowing their horns late at night when seeking admittance, and the night man is usually busy washing cars and fails to pay immediate attention to the request.

A method of calling the attendant automatically is shown in the illustration. If desired, the device can be arranged to open the doors as well. It is but another application of the well-known Hughes' induction balance, a device of a thousand uses.



Running the car over the buried coils throws them out of balance and rings a bell for the garage attendant

Two coils, alike in every detail, are buried in the ground directly in front of the garage door. These coils are carefully waterproofed and have separate leads running back into the garage. Here two similar coils are mounted. One coil of each pair is connected to the lighting mains through a switch that is used to disconnect the device during the day. The other two coils are connected to a relay similar in construction to an alternating-current voltmeter with the exception that the pointer is arranged to close two contacts when it moves.

This alternating-current relay may control a bell or other signaling device placed in the rear of the garage. Or a second relay may be connected in the circuit to control a motor to open the garage doors.

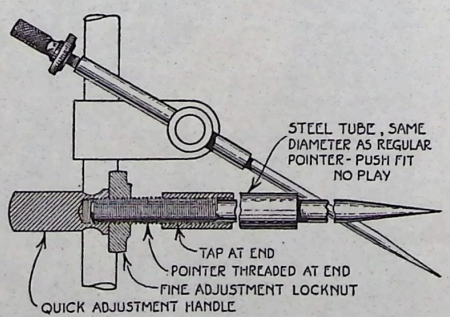
The operation of the device is practically self evident. The coils are so connected that the currents induced in them balance, thus the alternating-current relay will remain open. However, when a car drives over the buried coils, the balance will be destroyed and the first relay will close. In this manner a signal will be given or the door opened as arranged.

A device like this is eminently practical and convenient.

A Special Surface-Gage Pointer

By H. H. Parker

THE sketch illustrates a fine adjustment attachment to a surface gage when a direct longitudinal movement of the pointer is required. It is intended to fit into the regular clamp body in place of the regular needle and consists of a steel sleeve the diameter of the original needle, made either of small sized tubing or of a piece of rod drilled out with a long drill of small diameter and then turned on the outside to the pointer diameter. The sleeve is threaded inside with a fine thread for a short distance at one end; the walls of the sleeve must be left thick enough for the purpose.



The illustration shows the sleeve and pointer. The locknut only secures the handle and does not lock the pointer

Then a pointer is made up to a snug fit into the sleeve; one end is left large enough to be threaded as shown. Drill rod is probably the best material for the pointer. A small flat nut and a longer one of smaller diameter are made up, the edges knurled and both threaded to fit the pointer. The flat nut acts as a locknut to hold the other one, and also as a slow-speed adjusting nut, while the longer one acts as a high-speed adjustment.

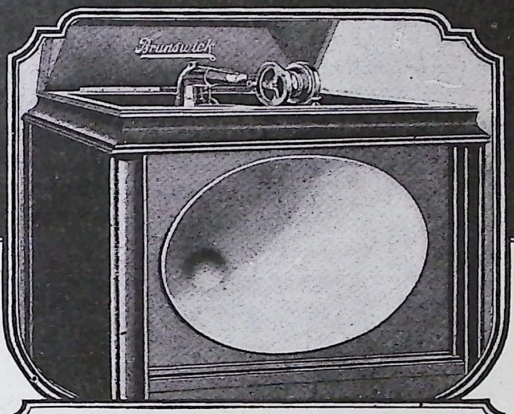
Scratch the Match on Your Pocket-Knife

THE three most essential requirements of the smoker are, first, something to smoke; second, a match; and, lastly, some place to scratch the match. As nearly all smokers carry a pocket-knife, the difficulty may be overcome by placing the knife in a vise and with a hard file make a series of notches across the back of the knife (as shown in the illustration). These notches need not be very deep, as the quantity counts more than the depth of the indentations.—MORTIMER TESSIER.

Notch the back of your knife and you will always have a match-scratcher

The Brunswick Method of Reproduction

An exclusive feature on The Brunswick—plays all records at their best.



The Brunswick Oval Tone Amplifier, built to conform to acoustic laws. A great improvement in tone projection.

Among many models, there is a size, price and finish to meet your requirements.

Remove the Grill

Examine the Oval Tone Amplifier

WHEN you examine phonographs, seeking to decide which make you prefer, note the shape of the Tone Amplifier. How does it compare with the oval horn of moulded wood on The Brunswick, as pictured above?

Look at the rear of the Amplifier—is there a cast-metal throat? Is merely the front of wood? Note that no metallic construction is used in the Brunswick Amplifier.

These are vital investigations. For upon the proper application of acoustic laws depends the tone quality of a phonograph.

The Brunswick Tone Amplifier is a later-day development. It brings improvements and refinements. It avoids old-time deficiencies. It brings finer tone, truer artistry.

Other features of the Brunswick Method of Reproduction are similarly superior. The Ultona, for instance, not only plays each type of record better, but it is the *only* one that is counter-balanced.

This cushions the contact between needle and record—doing away with the usual "surface" noises. It likewise prolongs the life and beauty of the record.

The Brunswick Method of Reproduction brings many epochal advancements. So no music lover, in face of such developments, can afford to choose a phonograph until he has heard The Brunswick and made comparisons.

Your ear will quickly appreciate Brunswick superiorities, and you will realize that great strides have been made in phonographic reproduction. And in addition, Brunswicks offer exceptional cabinet-work.

Go to a Brunswick dealer. Hear this super-phonograph. Judge for yourself. Ask also to hear Brunswick Records, playable on all phonographs with steel or fibre needles.

THE BRUNSWICK-BALKE-COLLENDER COMPANY

General Offices: 623-633 S. Wabash Avenue, Chicago

Branch Houses in Principal Cities of United States, Mexico and Canada

Canadian Distributors: Musical Merchandise Sales Co., 79 Wellington St., West, Toronto

Brunswick

PHONOGRAPHS AND RECORDS

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There are men who can do some *one thing* better than anybody else on earth.

But it takes a tremendous and highly organized body of men to do a number of things *as well as they can be done.*

The United States Rubber Company extends all over the world and its Bicycle Tires are made by some of the finest workmen to be found anywhere.

Just as much *thought* and *care* are exercised in the manufacture of U. S. Bicycle Tires as in any of the other products this company turns out.

"Ride a Bicycle"

United States Tires

United States Rubber Company

Camels ring true!

They'll give you new notions about how delightful a cigarette can be

YOU get to smoking Camels because you appreciate their fine, refreshing flavor! And, you like them better all the time because they never tire your taste!

Camels quality makes Camels so appetizing, so continuously delightful. And, Camels expert blend of choice Turkish and choice Domestic tobaccos gives them that wonderful mildness and mellow body.

You have only to compare Camels with any cigarette in the world at any price to know *personally* that Camels are a revelation.

Camels are sold everywhere in scientifically sealed packages of 20 cigarettes for 20 cents

R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

Camel

49974 A

The instrument that is the greatest artists

All these great artists make records for the Victrola:

ALDA
AMATO
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CARUSO
CHASE
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JOHNSON
JOURNET
MARTINELLI
McCORMACK
MELBA
RUFFO
SCHUMANN-HEINK
SCOTTI
SEMBRICH
TETRAZZINI
WERRENRATH
WITHERSPOON
ZANELLI

Violin

ELMAN
HEIFETZ
KREISLER
KUBELIK
ZIMBALIST

Violoncello

KINDLER

Piano

CORTOT
PADEREWSKI
RACHMANINOFF

Orchestra

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VICTOR HERBERT'S
PHILA. SYMPHONY

Also records by the late Gerville-Reache, Gilibert, Patti, Plancon, Powell, Tamagno, and Williams.

WHILE the power to stir vast opera and concert audiences is the heritage of the greatest artists, to the Victrola belongs the privilege of disseminating their art in countless homes throughout the world.

The Victrola *is* the greatest artists in the homes of the people. Look at the list of Victor artists shown here. Practically every artist worthy to be called "great" in this generation has allied himself with the Victor. This is no mere coincidence, but the result of deliberate choice by those whose genius makes their judgment final.

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Victrola

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Camden, New Jersey

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Camden, N. J.